HELPS

TO A

CORRECT

Understanding of Nature,

ON THE BASIS OF REALISM.

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PREFACE.

The doings and mysteries in nature invite our search. We see that all earthly things are undergoing change; what changes them? We discover that atoms, bodies, earth, worlds are in motion; what moves them? Does matter move itself? or does something not matter move it? Or is there nothing that is not matter, and is matter all that is? What is matter any how, is there any such thing, or are our thoughts of things as solids mere delusions? What do we know about matter, and how do we know? Do we know even that we are, and what we are? What is man, an atom, a monad, an ephemeron, dust, and nothing more? Are all our thoughts baseless imaginings, and all our hopes delusions? Is there no reality, and does man know nothing?

These questions are so plainly answered in the common consciousness of the common world that some of the questions themselves seem absurd; but in philosophic science they are questions, the questions of the day, and questions which are often so answered as to leave before us only a negation, a blank, a void. Where shall we go to find answers to these questions, to books? The books of modern science present to us nature in the garb of some hypotheses. The language employed in describing facts is the language which the hypotheses suggest, and the hypotheses are so interwoven with the facts and the language is so much of it born of the hypotheses, that it is often difficult to ascer-

tain from books the simple facts. Before we can know what the naked facts are we have to institute a process of analysis, and express to ourselves the facts in language which does not involve the hypotheses. Instead of stating the facts in the common language of men, and then explaining them by their hypotheses, scientists employ the language of the hypotheses in stating the facts. Take an example or two from "Story of Creation," which happens to lie on the table before me. This, for instance, p. 14: "The tendency of all passive Energy is to be converted into active Energy until a dead or uniform level is reached, wherein no differences of separating power remain." The casual reader, passing over this, might think that the author was telling some new and important fact. Translated, it becomes the familiar fact known to everybody, that heat passes from a hot body to adjacent cool bodies till they all become of equal temperature. Another example, p. 138. The author is describing how the "star dust" became worlds: "As the atoms rushed together, Energy, which had hitherto existed in a state of rest as passive separation, became active in molar and molecular form." Sifted from the involved hypotheses, this means: As the atoms rushed together they became hot, and the body thus formed whirled around on its axis and in an orbit. These cases, selected by opening the book at random, are examples of the common mode of stating facts in all such books. This writer thinks it possible to express scientific facts in the language of common life.

But behind these hypotheses, before these investigators enter upon an explanation of nature, they assert that man cannot *know* physical things, that all that we can know is certain appearances which pass before us, or, perhaps only our own thoughts and mental states; that is, they are phenomenalists or idealists, and they explain nature according to these systems of metaphysics.

To present a view of nature which overthrows all our preconceived notions of it, is very astonishing, and it gives us very exalted opinions of the persons who can see things in such new and extraordinary aspects. We feel very much abashed when they tell us that we do not know anything, and that all our opinions of nature are errors, vulgar follies. But when we come to consider that those who thus abash us assert that they do not know, that no man can know, anything about real things, we think it possible that their views may not be entirely correct. They claim to know nothing about reality; then possibly it is not the real world that they have been describing to us, but an imaginary one. At all events, we who believe that we can and do know real things have some confidence in our observations, and wish to know about nature as it is presented to us by the facts which come through our senses.

Very few of the people are idealists or phenominalists, nearly all are in some sense realists. The idealist tells us that we do not know the things which we call nature, that we do not know that there are any such things as matter and material bodies. The great common mind of the world replies, "I know better; I know that there are hard, solid things—trees, houses, men, rocks. I know them as they are, and they are as I know them to be." Thus we and our guide part company in the start; and we do not care much what his speculations are about a world that he says he does not know anything about. Yet we wish to know more of these things than we can at once discover, about the relation of things to each other, about the phenomena and the doings and doers in nature.

If idealists go where our realism will not permit us to follow, shall we therefore have no philosophy of nature? If phenominalists have constructed their system of physical philosophy in harmony with their phenominalism, may

not we have, ought we not to have, a system of physical philosophy in harmony with our realism?

This writer is of the opinion that the explanations of many natural phenomena lie much nearer the surface than where they have been sought, and are much more simple than many have supposed. Nothing is so plain, simple, and easy of access as truth. Nothing is so complicated, devious, and strange to thought as attemps to explain natural phenomena on the basis of a false assumption.

This work is not an argument with idealists, or phenominalists, or materialists, or agnostics, to convince them that they are mistaken. We assume that our audience is composed of persons who believe that our observations of nature are generally reliable data of opinion; and probably most of our readers believe in a personal Creator who created all things and adapted them to each other, and created the human mind and made it capable of discovering and knowing the things by which we are surrounded. Starting with the opinion that mankind are capable of *knowing* material things through their senses, and the invisible through process of reasons, we would inquire, What is science? What is the truth in reference to nature? What explanations of natural phenomena are we permitted to make, can we make?

This, then, is a humble attempt to lay the foundation for a system of physical philosophy in harmony with our system of metaphysics. We would not have realists remain dependent upon phenominalists for their physical philosophy. Let them have their physics in harmony with their metaphysics, if they wish, but let us have our physics in harmony with our metaphysics. No one has in recent years favored us with a view of nature from the standpoint of realism. It may be very imperfectly done here; but, in the absence of any other, the author has done the best he could.

Everyone lives in contact with the world, daily witnessing its phenomena, employing its agents, and conforming to their modes. From this experience every person forms some opinions of nature. It is probable that the deepest reach of philosophy will find many of these opinions correct, and that this treatise will be found to be largely an exposition of nature as it is seen and known by the great mass of the common people of the world, as far as nature may be known by direct observation, and not inconsistent with these views in reference to the more occult processes of nature.

Then let us go forth and examine nature and see how things appear to us. Regarding the theories of science as still open questions, setting aside for the time the dicta of authority, let us examine and think for ourselves.

NOTE.—This work was originally written in 1870 and 1871. Since then it has been re-written, and greatly abridged; but the original manuscript contained the new theory of the physical forces here presented; and that theory was announced and defended in a series of scientific articles published in the Northwestern Christian Advocate, of Chicago, in 1873 and 1874. I mention this because precisely the same theory was set forth in a book published in 1877. It is not certain that the author of that book caught the hint from my published articles of 1874. Often when public opinion has reached a certain stage of progress, a new thought will come to different minds remote from each other and having no dependent relation to each other. Whether Mr. Emerson's doctrine of the "Over-Soul" explains this or not, we know that such is often the case. But it is very certain that he who wrote in 1871 and published in 1874 is not indebted for his thought to a work published in 1877. See Northwestern Christian Advocate of Sept. 9 and Oct. 14, 1874, first page in both cases.

TITLES OF CHAPTERS.

CHAPTER I.

Relation of Metaphysics to Science.

Much commendable effort has been made during the past few years to popularize science. Many books have been written to make known to the reading public especially the theories by which scientists would explain natural phenomena. Many scientists agree that certain theories are probably true; some regard them as open questions, still on trial before the world; some look upon them as provisional theories, the best we have now, which are destined in time to give place to others; others consider them already established doctrines, and use them as evidence in other departments of truth.

Science naturally divides itself into two questions: (1) What are the facts in nature? and (2) what theories do these facts indicate? Observers and experimenters are the proper persons to answer the first question; logicians and philosophers the second. The opinions which we form in answer to the second question depend very largely upon the logical and metaphysical principles which we entertain and which we take to guide us in our processes of thought.

Scientists sometimes seem to regard it as an intrusion and impertinence when metaphysicians bring forward their

principles as tests of scientific theories. They do not seem to realize that their own metaphysics has determined mainly the form and structure of their theories. They only need to think for a moment of the importance they attach to the metaphysical principle which has been denominated the law of continuity, or the unchangeable quantity of existence, to see the impropriety of forbidding the use of metaphysics in scientific theorizing. Nearly all that is peculiar and characteristic in modern scientific theories is based on the *a priori* assumption of endless continuity of being, with limitless possibility of change. Descriptive science is dependent mainly upon observation; but when we begin to construct theories and systems, we commence to arrange facts in certain relations, and the science of relations is metaphysics. One set of metaphysical principles suggests and allows one arrangement of facts in a system, and another set of principles suggests and allows another arrangement of the same facts.

Popular opinion is that scientific theories depend entirely upon observed facts, and that the new theories which have appeared in late years are the results of newly discovered facts. Even metaphysicians who do not adopt the systems of metaphysics which they discover in scientific speculations, have not seemed to realize to what extent the forms of the theories are consequent upon the systems of metaphysics adopted by those who constructed the theories.

These questions are asked: Do not scientists know the facts which support current theories? and are they not as capable as any of judging whether the facts do or do not prove these theories? Do they not know all the facts which may be brought against these theories? and do they not know as well as any whether these facts do or do not disprove them? To these questions we answer: They

know all the facts; but with one set of metaphysical principles, certain facts prove and other facts do not disprove a theory; while with another set of principles, the former facts do not prove, and the latter facts do disprove the theory. The question respecting scientific theories is not a question between scientists and metaphysieians, nor between facts and metaphysics, but between one system of metaphysics and another system of metaphysics, while dealing with the same admitted facts. The system of metaphysics, more than the facts, determines the theory. We may illustrate this by presenting a specific case.

One man believes that it is folly to inquire in reference to causes, thinks that we can know nothing of any such things, not even that they are. What is called the causal relation can have no guiding or limiting powers upon his speculations. He can construct theories which ignore the existence of causes, and which positively and constantly violate the causal relation. He may arrange his facts in any system that suits his convenience.

Another man admits that causes are, but asserts that they are to us "unknowable." If we say to either of these men: You have changes without causes, he well answers: We know nothing about causes, or their supposed relation to phenomena. As that supposed relation is unknowable, we do not consider ourselves bound to observe your view of it, and you do not know whether we have violated it or not. Such a man does not deem it necessary to pay any heed to the law of cause and effect. He can construct his theories without any reference to it. To say that his theory violates the law of cause and effect, is to him no proof that his theory is false or incorrect.

Another man admits that things are related to each other as causes and effects; but by cause he means that which uniformly precedes, and by effect that which uni-

formly succeeds. With him the causal relation is only a time relation—going before and following after. The day is the cause of the night, and the night is the cause of the next day, and so on. Spring is the cause of summer, summer the cause of autumn, and autumn the cause of winter. Or, speaking of effects, we may say, night is the effect of day, day the effect of the preceding night, and so on. All that is necessary for this man, in the construction of his theories, is that he preserve the proper order of succession. If any one should attempt to test his theories by the law of cause and effect, all that is necessary in vindicating his theory, is that he show that some phenomena preceded, and other phenomena succeeded, the phenomena with which he deals, in their true order of succession.

Another man admits that things are related to each other as causes and effects, but by cause and effect he means the same existence in two different successive forms. Thus ice is the cause of water, and water is the cause of steam. Or we may speak of the effects, and say water is the effect of ice, and steam the effect of water. All that is necessary in the construction of his theories is that the quantity of existence be preserved unchanged in the successive changes in form. As a proof that his theory is properly constructed, he shows that the order may be reversed, and we may say the steam is the cause of the water, and the water is the cause of the ice. If it be alleged that in his theory he has effects without causes, he has only to show in reply that there was an equal amount of existence in some other form preceding his effects.

Another man believes that the cause energizes to produce the effect, and that unless it does, the two do not stand in the relation to each other of cause and effect. He believes that all changes are the results of the energizing

of something. With him the causal relation includes the energizing of the cause to produce the effect. He cannot receive as true any theory which relates things in a way which violates this opinion.

Here are five doctrines respecting cause which are more or less current in the world. According to the one of these which a man adopts will be the form of his scientific theories, based upon the same admitted facts. When, then, I am informed that certain facts prove a certain theory, before I can have confidence in my informant as an authority, I must know which of these doctrines of cause he adopts. With one of them his theory may be in accordance with the facts, while with another one, in view of the facts his theory may be entirely impossible. According to the first four of these doctrines, theories and explanations of natural phenomena are allowable, which according to the last are impossible. The first four of them can co-operate, because they all agree in rejecting the last. The last can have no fellowship with any of the others, and he who adopts it can admit no theory constructed according to any of the others, and in violation of this.

The last of these doctrines is the one universally held by the popular common sense of mankind. Every man considers himself a cause from the fact that he energizes to produce results. This is the view of cause universally entertained by the common people. It is also the one that is entertained, and that has always been entertained, by the largest and best class of metaphysicians. But certain metaphysicians declared and promulgated the other four doctrines. Scientists, after a time, adopted them, one or another, or all of them, and began to construct theories according to them, and in disregard of the last. It is thus, and thus only, that some of the most important theories of

modern science have become possible. It may now be said that the first four of these doctrines are factors in the metaphysical basis of all modern science. Whoever receives and believes the last of these doctrines, must, while handling the same facts, arrive at very different conclusions from those reached by men who have adopted any other of these doctrines of cause. Theory-constructing and system-building are arranging and relating facts, and depend upon the principle of relation which the builder entertains.

Again, our opinions of scientific theories depend very much upon whether we do or do not admit the existence of fundamental, absolute, or necessary truths. Upon this question metaphysicians are divided; at least some metaphysicians have denied that there are any such truths. If we admit that there are certain fundamental truths which we must not violate in the construction of our theories, we are limited and restricted in our work—we must construct our theories according to those truths. If we deny that there are any such truths, ignore them, and construct our theories without reference to them, we have greater liberty—we may construct almost any theory we please. Others may say that one part of our theory contradicts another part. We may answer: That is nothing to us; we do not admit the authority of what is called the law of contradictions, nor of any other alleged absolute truths. On the other hand, if our creed embraces such truths, they are guides to us in the construction of our theories. If we do not recognize them at all, they are no guides to us, and they impose on us no restrictions. In the construction of the present prevalent system of physical philosophy much has been done by persons who have adopted the systems of metaphysics which deny the authority of any such truths. The question arises in the minds of many:

To what extent are the wonderful theories which so distinguish modern science dependent upon the systems of metaphysics which scientists have adopted? What modifications in these theories would some other system of metaphysics require? What must be our opinion respecting these theories from the standpoint of some other system of metaphysics? There are many who do not adopt any of the systems of metaphysics upon which modern science is built; does this fact require them to modify or reject its theories?

We may be a little more specific and mention the bearing of certain specific systems of metaphysics upon the structure of physical philosophy. Sensationalism, denying any innate characteristics of mind or necessary modes of mental activity, turns man out upon the objective world alone for his evidence. Its antagonist, intuitionalism, finds in mind itself certain necessary modes of action, which are thought to be adaptations to and intimations of objective facts, and these necessary modes of thought are supposed to aid, limit and direct our opinions respecting objective things. Phenomenalism limits our knowledge to appearances, idealism to our own mental states and acts, and we know not that there is any real thing in the material world. All we know is that certain appearances are presented to our minds, or that our minds perform certain acts. On the other hand, realism of various shades and kinds includes in our knowledge not only appearances, but *things* as they really are. The word realism has had two significations in philosophy. Formerly realism was the opposite of nominalism. These words then had reference only to the content of general terms, such as man, horse, brute etc. Nominalism claimed that such words were only names, names having no corresponding things. Realism claimed that they were names of real things.

This has ceased to be a question of much interest in philosophy. Nearly everybody has concluded that these terms are not names of things but only of groups of qualities.

But in modern philosophy the word realist has come to be used as the opposite of phenomenalist and idealist, and means a believer in man's knowledge of reality, as distinguished from mere appearances or mental activities. Of course, as our opinions are with the phenomenalist or with the realist, will our views of the physical world, of scientific theories, and our system of physical philosophy, be different. Sensationalists, associationalists, and phenomenalists, generally deny the existence of any absolute truths; many idealists do not, and realists generally believe that there are a great many absolute, immutable, and eternal truths, which are and must be true, whatever else may be said or thought.

Now, if any man believes that these alleged absolute truths are merely generalizations from observation and experience; or that they are merely the result of habit, custom in thus associating thoughts, or that we think them true merely because we cannot comprehend their opposites—that is, that they are grounded only in our weakness—if a man entertains any of these opinions respecting alleged absolute truths, they have no weight of authority with him, more than any other generalizations, or habits of thought, or limits from human weakness. On the other hand, if we believe that they are really absolute truths which cannot be refuted, contradicted or even questioned, we know that our opinions in physical science, and in all other departments of thought, must be conformed to them. According, then, as we receive or reject these must our systems of physical philosphy be very different. It is not probable that any one, however positively he may deny the validity of absolute truths, will directly

assert that two contradictory statements can both be true, or that it is not always true that a thing is equal to itself; yet by fixing it as a general rule that all such truths must be excluded, and that they must not be allowed to have any voice in determining our opinions of physical nature, great liberty is secured in the construction of theories and systems, and many are constructed which a regard for such truths would forbid, and which these truths utterly demolish.

It is folly to exclude metaphysics from all voice in the construction of theories and systems of physical philosophy. As I have already said, theory-constructing and system-building are the application of metaphysics to physics. Science cannot advance a single step beyond observation, cannot take the first step in physical science —classification—without using the metaphysical principle of likeness. Likeness has no corporeity, no body, form or size. We cannot see it, or hear it, or handle it. It is a super-material, meta-physical abstraction. Thus we see that differences of opinion in reference to scientific theories do not result from the fact that one employs metaphysics as a help in their construction, and others do not—for all employ it—but upon the kind of metaphysics employed, upon the different principles used.

A large majority of mankind, both the learned and the unlearned, hold to a system of metaphysics which includes the four following principles: (1.) Energizing is a necessary factor in the causal relation. (2.) The human mind has positive characteristics and necessary inborn modes of action. (3.) We do know things, and not merely appearances. (4.) There are absolute truths which are the ultimate tests of truth in all philosophy. Among those who constitute this majority I class myself. The metaphysical system which you and I and most men adopt,

includes these four propositions. If the existing theories and systems of physical philosophy have been constructed by those who did not include these principles in their system of metaphysics, if their metaphysical principles are the contrary of these, their system of physical philosophy must be different from ours, and ours different from theirs. If we are satisfied that our system of metaphysics is true, if we are certain that we have the truth in this, we cannot receive as true any physical system or theory of natural phenomena which contradicts the truth we already have. To do so would be to entertain a contradiction in our own minds. Two contradictions cannot both be true. Then we must either give up our metaphysics or our contradictory system of physical philosophy. But in our metaphysical system we have this principle that there are certain absolute truths which lie at the foundation of all truth, which are the ultimate judicature in all philosophy, metaphysical and physical. Certainly the dependent cannot require that the fundamental, upon which itself depends, shall get out of the way, or be given up. One of these truths we have just employed—two contradictories cannot both be true. We hold this to be a bottom principle, applicable to all thought and all fact, physical and metaphysical, in all periods of time and in all worlds. Thus the basal principles which lie beneath all facts, and which must determine our opinions of all facts, and must determine the facts themselves, lie in our metaphysics. It is thus the prime authority before which all else must fall. It is only the absoluteness of its own authority that consigns one of two contradictory philosophies to oblivion; it is its own authoritative voice that commands one to vacate the arena, and it is not self-annihilative; it does not command itself to vacate.

But perhaps some one says: The scientist will not

admit what you call absolute truths as evidence, nor allow them to be applied to scientific questions. What matter? I do not care whether he admits them or not; though I know that, whatever he may say about it, he will admit them practically, even the one that we have just been using, and if one of his experiments contradicts another of his experiments, he will throw away one of them, and say they cannot both be true, and try again. But I am not talking with scientists who forbid the use of metaphysics while using it themselves, nor with those who have a different system of metaphysics from that which I have outlined above. I do not propose to try to convince any one that this is the true system of metaphysics, nor to discuss further the propriety of applying metaphysical principles to scientific theories. I do not propose to try to convince any one who has built his physical philosophy upon a different metaphysical foundation that he is in error. I suppose myself conversing with that great majority of which I have spoken, who agree with me in the four metaphysical principles stated, and say to these my friends: According to these fundamental principles of philosophy which we all hold in common, what must be onr opinions of the physical world? What views must we have of nature? What must be our opinions of current scientific theories? What in general must be our conclusions respecting the system of physical philosophy which appears now before us in the world? It has been very ably and laboriously wrought out as it could be on the basis of other systems of metaphysics; what has our system to say in reference to it? What modifications would our system require us to make in it? We enter upon an examination of the physical world to see what views we must take of it in the light of our system of metaphysics. If you agree with me in the general system which I have mentioned, I

invite you to accompany me in an excursion among the works of God, for the purpose of endeavoring to obtain a true understanding of nature. If the present current system of physical philosophy is possible under the direction of the metaphysics of phenomenalism and the exclusion of absolute truths, how is it under the direction of any system of realism and the admission of such absolute truths?

CHAPTER II.

MODES OF INVESTIGATION.

In the investigation of natural phenomena five modes of procedure have been common in all ages. (1.) Observing facts, and deducing from them principles, or laws of being and doing. Many facts, because of their resemblances, admit of classification. These facts are all according to the same mode; that mode, then, is a law or principle in nature. Thus, we notice that bodies left unsupported in the air fall to the ground. This we have seen to be the case in so many instances that we say it is a law or principle in nature that all bodies left unsupported near the earth fall to the ground. Other facts, unlike these, but like each other, are classed together, and we say that their mode is another law or principle in nature. Thus we have noticed that when bits of wood, cork, and many other things, are put down in water, they rise up through it and rest on its surface. Hence we say it is a priuciple or law in nature that bodies of less specific gravity than water, rise up through the water and rest upon its surface. Any new fact is thought to be explained when it can be classed with or placed under any of these already deduced modes or laws. Thus, if we put bits of iron or lead in a dish of mercury, these bodies rise up through the mercury and rest on its surface. Explanation: These bodies are lighter than the mercury, and

hence rise up through it, just as bits of wood do through water. Sometimes the principle thus obtained is so general that it is decided to be universal. Thus the principle, all bodies left unsupported in the air fall to the ground, is thought to be true on all the planets, on all worlds, universally. Such a principle is called a generalized universal, This mode of procedure has in later times been called the inductive method. It is also called generalizing, and for many years it was called the scientific method.

(2.) The second mode of procedure is this: When a principle has been found so extensive that it has been generalized into a universal, that principle is taken as a guide to our opinions. Finding so many things according to this mode, we conclude that all things of this class are according to it. If, then, a new object of this class is presented to us, we say that it is according to this principle, before we have ascertained by observation or experiment that it is so, and even when the circumstances do not admit of verification by observation or experiment. Thus, if a new planet should be discovered, we would say that a body left unsupported a little distance from that planet would fall to it. This method is sometimes called reasoning from analogy. All scientists use this method, none more so than those who say, "We have no right whatever to ascertain a single physical truth without seeking for it physically."

(3.) The third mode of procedure is this: Men find themselves under the necessity of thinking after certain forms of thought. These necessary forms or modes ot thought have been denominated intuitions, or subjective principles. These have been taken as indications of the modes of objective things. This has been called the intuitional method. While this has as much influence, per-

haps, as any other method in determining the opinions of mankind in general respecting external things, it is not admitted as valid by scientists, and there is so much of doubt surrounding it in scientific minds that we shall not rely upon it or use it in our investigations of physical nature till we have ascertained the truth by other mothods.

(4.) The fourth method is as follows: Men see by the nature of things that certain facts must be true of them, and cannot be otherwise—the opposite is an impossibility. They formulate one of these necessary facts, express it in words, and call it an absolute truth. From this absolute truth they form opinions of how things must be, and how otherwise it is impossible for them to be. From these we form opinions of undiscovered things, and of facts respecting discovered things which cannot be otherwise ascertained. This may be properly called the metaphysical method.

The second and fourth of these principles have been by some indiscriminately called the deductive method; and the principles obtained by both of these processes are sometimes called "a priori" principles. They ought to be carefully distinguished. They are alike in that both take principles as the basis of opinions respecting objective things. But they are very unlike in the origin and authority of the principles. A generalized principle can only prove that things are probably so. Take the principle, all small bodies left unsupported near a large body, fall to it. We suppose that this principle holds true of bodies near the remotest star. But we have no evidence but analogy from our solar system, and some slight indications of motion in some other heavenly bodies, that there is any such power as gravity in connection with that star. It is possible that there is no such power as gravity there. When, then, this principle is applied to that star,

its opposite is possible, and the fact is only probable. An absolute truth declares that things must be so, and cannot possibly be otherwise. A generalized principle is proof only until opposite facts are discovered. If facts which appear to be contrary to it are discovered, we cannot say, we know they are not contrary, the apparent facts must be set aside, the principle makes it necessary that facts be according to it. It was a generalized universal only because no contrary facts were known. Now that contrary facts have been discovered, it ceases to be a universal principle—it is true of some things, of others it is not true.

All four of these modes have been used in all ages of the world. They are distinguished from each other by their premises. In the first mode facts are the premise, and a principle is the deduction. That principle is the premise in the second mode. In the third mode necessary forms of thought are the premise. In the fourth process absolute truths are the premise. In the early ages of the world comparatively few facts were known, but men could not wait for further discoveries before forming systems. Man's impulse to system-building has led to the construction of systems of natural philosophy by every generation of men. Men have always taken as a basis of their systems the few facts known to them. In the absence of more numerous facts, there was much reliance upon intuitive or subjective principles and absolute truths. Their errors generally arose, however, not from the misguidance of subjective principles or absolute truths, but from mistake in reference to the facts. The Ptolemaic system of astronomy, for instance, was based upon mistaken facts—the whole heavens seemed to revolve around the earth. These were the supposed facts which constituted the basis of the system.

(5.) The fifth process is as follows: From the intimation of a few facts, for the purpose of explaining these and like phenomena, a supposition is made, or an hypothesis is formed, and then efforts are made to ascertain how well that hypothesis will explain these phenomena. On the basis of this supposition can we account for and explain these phenomena? Do these phenomena accord with that supposition? Do they sustain that hypothesis? I thus change the language of the question because it appears to me that the phrases, does it explain the phenomena? does it account for the phenomena? do the phenomena accord with it? and do they sustain or prove it? are practically the same. If the supposition or hypothesis is found to accord with a considerable number of the phenomena, it is called a theory. A theory is an hypothesis sustained by some gathered evidence. Efforts are still made to discover its accordance with other, with all related phenomena. If there are found some phenomena which cannot be explained by it, with which it does not accord, the theory is somewhat modified to adapt it to these new facts. If, on further examination, there are found some facts which it will not yet explain, still other modifications are made in it. Thus by successive modifications, the endeavor is to construct a theory that will explain, or accord with, all related facts, all facts that are within the field of that theory.

This endeavor is prosecuted by different persons, in different countries, and through successive generations. These endeavors constitute a very large portion of the work of scientists, and comprise a large portion of scientific literature. This is the favorite method with modern scientists. It is not true that the Baconian method is the scientific method of the age. Men do not go forth accumulating facts, and deducing from them theories; the theory is already formed, and they are seeking facts to

test it, or to prove it. Men do not go forth performing experiments hap-hazard to see what their teachings are, without any opinions of the results. The theory is already formed, and according to it they anticipate the results, and now they perform the experiment to ascertain if the results accord with their anticipations, and thus confirm their theory. It is not true, as some suppose, that Lord Bacon discovered or invented a new scientific mode. That mode which I have designated as number one, was the method which he recommended, and it has always been the first method of mankind in all ages of the world. He defined it more clearly than it had ever been defined before, and analyzed it and gave names to certain classifications within it; but no man has ever followed his analysis and classifications, but all men have gone on using it, as they had always been using it.

Nor is it true that modern science is the fruit of the Baconian method. Because the extraordinary burst of progress in science which Newton inaugurated occurred soon after Bacon's time, many have attributed it to his influence. It is true that Sir Isaac Newton, who has been styled the father of modern science, began his brilliant career of investigation soon after Bacon's death; but Professor W. S. Jevons says: "There is no evidence, from his writing or from any other source, that Newton ever read Bacon's works." It is certain that he did not follow his mode. From the intimations of a few facts—probably more than simply the fall of an apple—he conceived the thought of the force of gravity. This was then a thought, a supposition, an hypothesis, in his mind. He then proceeded by observation and experiment to test and verify this hypothesis. During these investigations the thought of its law or mode of increase and decrease from distance was suggested to him. This was another hypothesis, or addition to his former one. He then proceeded by obser-

vation to test and prove this. He has now the hypothesis of the force of gravity and its mode or law. He then asked himself the question: "Will this account for and explain all related natural phenomena, including the motions of the heavenly bodies? The endeavor to show that it will, constituted the largest item in the work of his life. This is not the Baconian method at all, but it is a good example of the one which we now have under consideration. This process of first forming an hypothesis, and then looking for the corroborating facts, is what Professor Tyndall calls "the use of imagination in science."

This process, when used in connection with other modes of investigation, is often very serviceable, and can often be employed in the ascertainment of truth. When certain facts suggest a supposition, it is perfectly legitimate that we adopt it provisionally, and then see if other facts corroborate it. There was no occasion for the condemnation of this mode, by Bacon or any one else; but it is not proper, while using it to condemn it, or to exclude any other legitimate mode.

In using this method we are liable to mistake in two ways: (1) in our earnest desire to find facts which accord with the hypothesis, the facts themselves may be distorted, or certain inimical facts may be excluded or covered up; or (2) following the indications of the hypothesis, and to answer its demands, certain facts may be assumed which are known to be facts only because the hypothesis demands them. Thus many opinions respecting the nature and doings of molecules have been assumed as facts, not because they are by any other means known to be facts, but because certain hypotheses demand that they should be facts. It becomes us to be very careful in admitting as facts opinions projected from an hypothesis and applied to things. They are of the nature of prophecies, and may or

may not be true, and until they are ascertained by other means to be true, they cannot be regarded as facts.

Suppose we proceed after this manner: An hypothesis we have formed, or a supposition we have made, indicates and requires certain facts. We cannot by any other means ascertain that they are facts, but we will assume them to be facts; and from these assumed facts we will construct another hypothesis respecting certain other things. This hypothesis requires certain facts respecting those things; we cannot by any other means discover that they are facts, but we will, on the strength of our hypothesis, assume them to be facts. From these assumed facts we will project another hypothesis respecting still other things; and this hypothesis demands other facts, and we will assume them to be facts; and from these assumed facts we will construct another hypothesis, and so on. Thus we may proceed according to this process until we have constructed an entire system of the universe. That would be a system constructed entirely upon imagination and faith; but these are not deemed a very stable foundation for a system of physical philosophy. If we follow back our track of progress, we will find that our whole system rests upon the truthfulness of our first hypothesis. If our first hypothesis is true, then such are facts; if these are facts, our second hypothesis is true; if this hypothesis is true, such are other facts, and so on. Thus our whole system rests upon the truth of our first supposition. We find too much of this in modern scientific speculation; and to this the words of Professor Tait are applicable when he says: "We have no right whatever to ascertain a single physical truth without seeking for it physically."

The test of this method is the law of contradictions. In the successive modifications of our hypothesis to adapt it to other facts, we may render it entirely inconsistent with the facts which first suggested it. We thus introduce into

it a contradiction, and an absolute truth comes in, and, wlth a voice as decisive as the voice of Omnipotence, pronounces our hypothesis false. It is thus that the hypothesis of an universal ether has suffered. That it might be competent to transmit light and radiant heat at their known velocity, it was necessary to give it such properties that it became impervious to the moving worlds. If we give it such properties that it becomes no obstruction to the passing worlds, it becomes entirely incompetent to transmit light and heat at their known velocity.

At best this method is a long and laborious process, and it can never attain unto a demonstration. The best we can do, usually, is to decide according to what appears to be the balance of testimony. Often two or more hypotheses will explain the phenomena about equally well, then each person will be disposed to accept the hypothesis which appears to him to explain the facts most perfectly. But the choice of men is not always thus determined. Every man knows that the hypothesis of direct divine agency in nature will perfectly explain all natural phenomena; but there are many who do not receive this hypothesis. Nor is this surprising. It seems very probable that there are subordinate natural agencies operating in nature; and to endeavor to discover them, and trace out their working, as far as we can honestly and reverently, seems entirely legitimate. In the prosecution of this endeavor we sometimes meet with cases where no other method seems so serviceable as this, to from a few facts construct an hypothesis, and then test it by an application to other facts. But neither this nor any other should be our exclusive method. We have need of all methods, and it is only by the use of all that we can hope to arrive at any true system of physical philosophy.

Here are five methods which have been more or less employed by all men in their endeavors to solve the mys-

teries of nature. The investigator may not have all, or any, of these distinctly defined in his own mind, distinctively premeditated as an instrument that he is going to use; but he goes forth intuitively using them as means for the enlargement of the bounds of his knowledge. Scientists of the present day employ the first, second, and especially the fifth, and often repudiate the third and fourth. Metaphysicians attach more importance to these; hence, there is apt to be some antagonism between science and metaphysics. It is unfortunate that science and metaphysics have been to so great an extent separated. It is folly to construct any system that requires for its maintenance the exclusion of metaphysics. It is vain to expect that metaphysics is to be exiled and shut out forever from its influence upon human thought. Subjective principles and absolute truths will in all future ages, as they have in all the past, lay the foundations of all enduring systems, and ultimately control opinion more than all other influences, and determine mainly the forms of human belief.

The two modes which scientists are disposed to exclude are necessary for the construction of any correct and complete system of physical philosophy. We can but tak with us our necessary subjective modes of thought. Those who theoretically repudiate them as guides do and must, of course, constantly use them, and rely upon them in all their mental operations. Absolute truths we need to take with us, for they declare beforehand what is possible and what is impossible, and save us the time and labor wasted in the construction of theories which may be easily shown to be impossible. They are infallible guides to us in our investigations. They are true, whatever else may appear. If our observations seem to conflict with them, we must set ourselves immediately at work to correct our observaitons. If our supposed facts contradict them, we may

throw our supposed facts to the winds. They and facts can never be at variance, and if such a conflict appears we may know that we have not yet obtained the facts. No appearances can weaken them; no number of apparent facts can impair their validity or stability. I do not propose to enter the field of controversy respecting them. I do not propose to try to prove that there are such truths. If there are no such truths, there is no ultimate test of truth, no bed-rock of human thought, and certainty in anything is unattainable to man. I shall therefore freely use them, without apologizing to any one for their use, and if the reader admits them, they will guide him to the truth; if he does not admit them, he will have to follow uncertain guides, or grope in the dark. If to the reader, as they are presented to him, they are absolute truths, he may know that whatever is not supported by them is uncertain, and that whatever conflicts with them is false, I do not say that all opinions expressed in the following pages will be supported by them, but I would not entertain any opinion which contravenes one of them, but we shall find that many opinions current in science would never have been promulgated or entertained but for the previous exclusion of their testimony from the halls of science. In the next chapter we will present a list of such of them as we may have occasion to use.

CHAPTER III.

Absolute Truths.

As stated in the preceding chapter, we do not propose to discuss the question, are there absolute truths? but merely present some that I regard as such, and leave the reader to judge for himself whether he so regards them. But before doing so we must define what we mean by the words substance, property and doer.

When we undertake to define a thing we would state some fact or facts respecting it that cannot be said of anything else, that distinguish it from everything else. Now, what can be said of substance that cannot be said of anything else? This, and this only, that it, of itself, has being in space, without having anything else below it or behind it upon which it depends. We may define substance, then, as existence which of itself occupies space. We may add by way of explanation of the word itself in this definition, that is not dependent upon anything else for the continuance of its being. We would not, in this sentence, join issue with those who believe that nothing finite continues in being except as it is sustained by divine power. With those who believe that nothing can subsist except as it is held in being by divine power, and with those who believe that nothing in nature moves except as God moves it, and those who believe that there is no real being but God, I have no discussion. But most people do

not so believe. The great mass of mankind think that matter is itself substantial existence, continuing in being by virtue of its own nature indestructibly, and that something that is not God moves matter. According to these views, without discussing these points, we frame our definitions, and endeavor to explain natural phenomena. By this definition we would distinguish substance from property or attribute. Of course a property extends through space as much as its substance. Wherever in space the substance is, its property is; but the property has no existence apart from its substance. It does not, of itself, occupy space. We may take away all properties, except such as are inseparable from any finite existence in space—location, extension, form and size—and yet the substance is there. But take the substance away and no property remains, nothing remains. Hence we say, substance is existence which of itself occupies space. The relation of this definition to immaterial substance will be considered in subsequent chapters.

A property is an inherent characteristic of substance. This definition limits the word to one class of properties, as they have generally been treated. We will hereafter have occasion to speak of the different classes of properties. At present we use the word only as here defined,—an inherent characteristic of substance, a fact which is not now dependent upon anything for its existence but its substance, Among properties, as the word is generally used, are included many facts—such as color, weight, and so forth—which are dependent upon something outside of the substance. We now limit the word to an inherent characteristic, dependent upon nothing external to its substance.

A doer is that which produces motion, or effects change. We sometimes exert energy upon bodies, and yet move nothing. In that case there is no doing, scientifically

speaking, and we are not doers. Energizing and doing, then, are not synonymous terms. We may energize and not do. Doing is energizing which effects change, or causes motions; and a doer is the thing which energizes, and thus produces the motion, or effects the change.

Absolute truths are propositions which are true independent of the mind that thinks them, independent of any being that declares them, true necessarily in the nature of things—their opposite is not possible. There are many such truths in mathematics and other sciences, but we will mention only such as we may have occasion to use in our investigation of natural phenomena. They may be classified in kinds, and we will thus classify them under the terms Absolute Truths, Included Absolute Truths, and Derivative Absolute Truths. I do not say that they may be known as true without a mental process. There is no knowledge without an activity of mind. But their truthfulness does not depend upon any process, or quality, or mode, in the nature of the mind that thinks them. Those of the first class are known as true by simply mentally looking at them—they are self-evident. Those of the second class are known as true by perceiving that they are included in some one of the first class. Those of the third class are known to be true by perceiving that they are included in some one of the second class.

ABSOLUTE TRUTHS.

1. All material bodies exist in space.

2. Every body is at a distance from all bodies that it does not touch.

3. Every body is some direction from all other bodies.

4. One body cannot occupy two different places in space at the same time.

5. All events occur in time.

6. Each event is simultaneous with other events, or before or after them.

7. All things in the universe are either substance or not substance.

8. Where no substance is, nothing is. I would except time and space; some would not make even these exceptions.

9. Nothing can do or be done where nothing is.

10. Two contradictories cannot both be true.

11. All material bodies have size, or dimensions.

12. Some bodies are larger or smaller than some other bodies.

13. If one body is larger or smaller than another, it is not of the same size.

14. There are more or less of some things than of others.

15. All material bodies have form.

16. All bodies have not the same form.

17. Things are like and unlike other things.

These I hold to be absolute truths. They are not dependent upon the mind that thinks them. All bodies exist in space. It is not merely that we must so think. Bodies could not exist ouside of space, for there is no outside of space. Then if they exist at all, they must be in space. That is not a fact that is made or decreed. It is a fact the opposite of which is impossible. If any being in any world thinks contrary to any of these propositions, he thinks a falsehood. There may be beings in other worlds, as there are on earth, who are incapable of the concepts expressed in these propositions. To such beings, of course, they express neither truth nor falsehood; but to all beings who can comprehend them, they declare the truth.

These truths are independent of mind to make or unmake them. No being, not even the infinite Creator, could make these facts to be otherwise than as they are. Take, for instance, the thirteenth. If a body is larger or smaller than another, it is not of the same size. If upon

a two-foot rule you place a rule that is only a foot and a half long, no being in any world could make it true that the two rules are of equal length. No being could make it true that when one event occurs before another, they occur at the same time; or that when there are more of some things than of others, they are the same in number; or that when they are alike in form, they are unlike; or that one body can be in two places in space at the same time—or, in other words, make one equal to two.

These facts would have been as they are if there had been no mind connected with their first appearance in reality, and no mind to think and know them. When a material body came into being it could not have been otherwise than in space; and its advent could not have been otherwise than in time, and it could not have been without form and size. If the material elements evolved themselves into shape, or even into being, these facts must have been as they are. If there had been no mind to think them there would have been no truth or falsehood in reference to them—that is, no agreement of thought with things; but the facts would have been as they are.

Here, then, we have a list—it might have been extended—of absolute independent truths. These form an infallible basis of universal knowledge, and every intelligent being in all worlds must think according to them, if he thinks the truth; and if he does not think according to them, he thinks a falsehood. These are infallible guides to us as we go forth in the study of nature. All theories and systems must conform to them, or be torn in pieces by them. On this rock must all foundations be laid, or ruin and disaster await the edifice.

Each of these propositions contains many others which might be made, expressing the application of some absolute truth to a class of cases, or to a limited number of objects. These we have denominated Included Absolute

Truths. They are as certainly true as the absolute truths themselves, because they are included in the absolute truths, and carry with them all the authority of the absolute truth which contains them. We might swell the list of included propositions to great proportions, but we mention only a few. The sixth of the foregoing absolute truths includes the following:

1. If an event occurs before another, it does not occur after it; and if we say it occurs after, we speak a falsehood.

2. If it occurs after, it does not occur before; and to assert that it occurs before, is to assert a falsehood.

8. If it occurs before or after, it does not occur at the same time.

4. If it occurs at the same time, it does not occur before or after.

The tenth of the foregoing absolute truths—two contradictions cannot both be true—includes the following:

5. A thing cannot be and not be at the same time; be and not be are a contradiction.

6. A thing cannot be and not be in the same *place* at the same time. If it is not there, to say that it is there is a falsehood; if it is there, to say that it is not there is a falsehood.

7. A thing which is not cannot do; do and not be are a contradiction.

8. A thing cannot do when it is not.

9. A thing cannot do where it is not; doing where it is not is doing without being—a contradiction.

10. No substance can do outside of its own limits; doing outside of its own limits is doing where it is not—a contradiction.

11. If a thing does, we know that it is, and that it is where it does, unless it uses some medium to effect remote results.

12. All doing requires a doer. This is another way of

stating number 7 above. Doing without being is a contradiction. Here is doing; then there must be being in the doer, something which is and does, and which cannot do unless it is. Doing without being in the doer is a contradiction. Doing without a doer is a contradiction. If there is doing, there must be being in the doer; the doer must be.

13. No property can be without a substance of which it is a property. Property of a thing which is not contains a contradiction—thing and no thing.

14. Where there is a property there must be a substance of which it is a property.

The eighth of the foregoing absolute truths—where no substance is nothing is—contains the following:

15. Nothing but substance can be translated in space, or moved from one place to another. Of course, this admits that where substance is moved, it carries with it its properties. Where no substance is nothing is to be moved. There can be no motion without substance. When substance is not moved, nothing is moved. Nothing but substance can be translated in space. Of course, that which does not occupy one place in space cannot be made to occupy successively different places in space. The ninth of the foregoing absolute truths—nothing can do or be done where nothing is—includes the following:

16. Nothing but substance can do, or be a doer. Where no substance is nothing is to do. Where substance is nothing else is but properties and relations, and these can never be doers. Then there is nothing there that can be a doer but substance. Nothing can move or be moved in space but substance. Nothing that cannot move or be moved in space can effect changes in other things, or cause motion or be a doer.

17. Then all doers are substance. Then whenever or wherever we discover doing or change, we know that

there is a doer, and that there is substance which is the doer.

Now if what we have here called included absolute truths are really included, they have all the authority and certainty of the absolute truths themselves. The only question that can arise in reference to them is, Are they included? The only answer ever given to number 9, by any one, including Kant, is the impossibility of explaining apparent facts, supposing matter to be the doer. This is a poor objection for a metaphysician to offer. Then the apparent facts are not real facts, or matter is not the doer. The statement in number 9 is true anyhow, and we must conform our physical philosophy to it.

Each of these included absolute truths contains many others which are applications of these to specific cases. These we have denominated

DERIVATIVE ABSOLUTE TRUTHS.

The twelfth of the foregoing included absolute truths—all doing requires a doer—includes the following:

1. Pushing requires a doer.
2. Pulling requires a doer.
3. Lifting requires a doer.
4. Separating requires a doer.
5. Uniting requires a doer.
6. Change requires a doer.
7. All motion requires a doer.

And as many more as there are kinds of doing.

The thirteenth of the foregoing included absolute truths—no property can be without a substance—includes the following:

8. No property can exist apart from its substance.

9. No property can be separated from its substance and continue to be.

10. No property can be transferred or communicated from one substance to another.

11. No property can exist when its substance is not.

12. No property can exist where its substance is not.

13. No property can exist beyond the limits of its substance; for then it would be where its substance is not.

14. If we discover a property, we know that its substance is, and that it is where the property is.

Thus we have two means of knowing when and where substance is: (1) If we discover doing, we know that there is a doer—substance—which does. (2) If we discover a property, we know that there is substance there, of which it is a property. The former of these has been called the law of cause and effect; the latter has been called the law of the relation of property and substance. They are both intuitive or subjective principles— that is, the mind must so think; but we do not here base their authority upon this fact, but upon the fact that they are included in absolute truths.

The seventh of the foregoing absolute truths asserts that all things in the universe are either substance or not substance. Whenever anything is discovered or spoken of, we can classify it under one or the other of these terms; and we should do so for the sake of clearness. Immense confusion has crept into natural philosophy through a neglect to do so. Substance and attribute are confounded, and one treated as the other. Properties and relations are treated as though they were real space-filling, independent existences. Indeed, is would seem that some men have raised a cloud of dust on purpose to obscure the line of distinction between substance and property. I very much desire to know of some men who treat very largely of force and energy, what they mean by them, whether they think them substances or properties; and whether they consider motion a substance or a relation. There is in much of modern philosophy a painful indefiniteness and obscuration of the idea of substance. No doubt this has resulted

largely from the opinion entertained by many that we can know nothing of substance, that we can know only properties, or only appearances, and from the influence of Comteanism in scientific study. By these we are cut off from all knowledge of reality, and shut up to phenomenalism, appearances, which may be delusions.

Besides these absolute truths there are some generalizations which are thought to be universals. They are sometimes classed among, and treated as though they were, absolute truths. They have no such authority as absolute truths, but they are often useful, though not infallible, guides. We will mention two or three of these:

An exertion of energy is necessary to produce motion. This is a generalization from experience and observation. We find that in every case where we can know the facts, an exertion of energy is necessary to produce motion. We know that when we start matter in motion, we do it by an exertion of energy. We know that the motion of every moving body which comes against us is attended with an exertion of energy. From these facts we conclude that in every case of motion, there is an exertion of energy to produce it. We have by an absolute truth limited the class of doers to substances. By this generalization we limit the class doers to those substances which are capable of energizing, or which possess the property of energy. This generalization is proof in all cases, until some instances of motion where there is no exertion of energy to produce it are discovered. No such instances have yet been found. Though this is a generalization, it is parallel with an included absolute truth—all doing or change requires a doer.

Another generalized universal is—All things in the universe are included in three denominations, substances, attributes and relations. This generalization is proof until something is discovered which is not included. Those

who think that these include all, count time and space among the attributes; some say attributes of the human mind, and some attributes of the divine mind. This classification cannot be used to prove that time and space are attributes of God, for it is a generalization made merely upon the supposition that it includes all; and if there are some things which are not included, some other denominations must be added. Make the classification, substances, attributes, relations, space, and time, and I know of nothing that is not included.

Another generalization is—"Nothing can never become something, and something can never become nothing." I suppose this generalization is put in this negative form for the sake of disproving something. The positive form of it is called the law of continuity, which asserts that the quantity of existence is unchangeable. Great use is made of this generalization in modern physical philosophy. It has been deemed sufficient to prove any point to which it can be applied. It is the basis of many scientific opinions, and performs a large part in the construction of many scientific theories. It reaches out into the invisible, and is deemed sufficient to prove existence of which we have no other evidence. It reaches back, and narrates the history of creation in the eternal past. It reaches forward and prophesies of the destiny of the universe in the eternal future. It makes matter eternal, or else a part of God. Even the infinite Creator could not change the quantity of existence; if he brought things into being, it was at the expense of his own being, for no change in the quantity of being is possible. It is somewhat amusing to see with what triumphant assurance some men use this generalization, while peremptorily forbidding to others the use of any *a priori* principles.

Such men give it all the authority of an absolute truth. The quantity of existence is unchangeable. Is it? Now

how do you know? We certainly do not see this proposition to be true by merely mentally looking at it. I see nothing impossible in the increase or decrease of existence. It is not a necessary fact in the nature of things, the opposite of which is impossible. It is not included in an absolute truth. Being and not being at the same time are a contradiction. But being at one time and not being at another time are not a contradiction.

It is not an intuition, or a necessary process of mind. Comparatively few of the human beings who have lived upon the earth have thought that way. True, to many of them the proposition has not been stated, but its opposite has been stated to them, and they have believed that. Most mankind now believe that when a stick of wood is burned, something goes out of being; and they have no mental difficulty in thus believing. When the indestructibility of matter was first stated as a scientific fact, few believed it. It remained the opinion of the few, even among philosophers, until Gay Lussac proved it by experiment.

Those philosophers who derive what are called necessary truths from human inability, place this among such truths. We cannot see how existence could be increased or diminished. Well, if principles based upon human weakness are the only tests of truth, we are indeed in a deplorable state.

This postulate is a generalization from observed facts. There is a persistence in being observed in nature, observed long before the indestructibility of matter was declared. In many cases when one thing was seen to enlarge, something else was seen to decrease. So many facts of this kind were discovered that men generalized that these cases were not a going out of being and coming into being, but a change from one form of being into another, and that the quantity of existence in these cases remained un-

changed. From these facts men made the generalization —the quantity of existence always remains the same. When the indestructibility of matter was demonstrated, that confirmed the generalization. When the idea that force or energy was persistent and changeable in form, was brought forward and some facts seemed to favor the idea, this strengthened still more the generalization. Thus we see that it is wholly dependent upon observed facts.

There is, however, in our mental constitution, an intuition which favors and helps in the construction of this and all other generalizations—that is, man's natural expectation of continuance, sameness, unity of being. What we see now to be, we expect has been and will be. But this expectation is a limited intuition, limited by the intuition of individuality, or the expectation of limits and bounds in space, and beginnings and endings in time, which we find to be true of individual things. Hence we are left to observed facts, after all, to determine what things continue, and what begin and end. Facts prove it true of material substance in the present order of things; whether it is true of anything else or not, we must ascertain by research and experiment. Attempts have been made to show that it is true of motion, and force, and energy. The generalization has no authority to decide beforehand in reference to these, or anything else that is within the reach of observation. We must ascertain whether it is true of them or not by first ascertaining what they are, and then by an examination of facts. The generalization may, of course, include time and space, for they, being illimitable, are absolutely unchangeable in quantity. The results of observation and experiment justify us in applying it to matter, and we may say that the quantity of material substance is at present unchangeable, by any finite power. It is probable that it may be extended to immaterial substance, and that we may say in general

terms, substance is unchangeable in quantity by any finite power. Further than this it will probably never be carried; for, besides time, space, and substance, there is nothing more but attributes and relations; and facts teach us that these are subject to change, and may begin and end, be and cease to be.

Generalizations never render contrary facts impossible. They are universals only so long as all discovered facts accord with them. The discovery of one contrary fact destroys at once a generalized universal. A generalization must give way before facts. An absolute truth will override any number of apparent facts—of course, there can be no conflict between an absolute truth and real facts. A generalization declares what probably is; an absolute truth, what must necessarily be.

CHAPTER IV.

MATTER.

We are now to enter upon the study of the material world. We must first explain and vindicate our definition of substance. We have defined substance as existence which of itself occupies space. It is the reality of which all appearances and properties are attributes. Much pleasantry and even ridicule have been bestowed upon the substratum which lies back of all properties, "pure being," into which properties are "stuck, like pins in a pincushion." This is a misrepresentation of the opinions of realists. No one believes in pure being as existence separated from all properties. Substance and properties may be logically, in thought, separated; but in reality no substance exists without properties. Here we have, at the beginning of our investigation, occasion for the use of some of our absolute truths: *All material bodies have location in space, extension, form, and size.* Location, extension, form, and size, are properties without which no material substance can be. And yet the substance does not exist only in these properties—it is not true that only location, extension, form, and size exist, or that these properties constitute the existence; but something exists which is located and extended, and which has form and size. Nor are these properties external to the substance, added to being, or "stuck into it;" but they are facts respecting being, and inseparable from it. These properties are not attached to bodies by their Creator, but they are necessary facts respecting existence. They are not created attributes; but if a body be by any means

created, these facts necessarily attach to it. There is no "pure being" separable in reality from these properties. When we have gone down to the bottom and reached the ultimate finite reality, we have existence located and extended, with form and size. This is to us the ultimate reality, and there is no finite being back of this, or purer than this. Such an ultimate reality is neither nondescript nor inconceivable. We do in thought, for logical and scientific purposes, distinguish between the located and extended reality, and location and extension, and call the former substance, and the latter attributes or properties.

It has been said that "A power of action is the only assignable difference between something and nothing." This statement assumes the whole dynamic theory of matter. Whether the molecules of matter are in constant motion, and have power to move themselves or not, is a question open for discussion, and the affirmative of this question is not proven by any *a priori* assumption of it. Whether matter has the power of action or not we shall subsequently consider, but before that, is the question of the existence and reality of matter. Is not filled space and empty space an "assignable difference?" I can conceive of material bodies either in motion or at rest, but in both cases they occupy space. The fact of their occupancy of space is more primary, then, than the question of their activity. Again it has been said, "Being has its existence only in its action." This is an expression of opinion, or it may be considered a thesis to be proven; but it cannot be advanced as proof. No theory of the nature of being can be established by inferences derived from the dynamic theory of matter. If that theory is denied, these inferences derived from it prove nothing in regard to the nature of being or substance.

I have defined substance by a fact which is never absent from substance, and never present with anything else, and which therefore clearly distinguishes it from everything else. Substance, having location and extension, occupies space, and each body or mass of substance fills a portion of space. *Where no substance is nothing is.* There can be no attributes, properties, or relations in space where there is no substance. Attributes, properties, and relations never do of themselves occupy space. A property occupies the same space that its substance does, and is as extended as its substance—wherever that substance is, that property is. The property occupies that space only because its substance does, and in the absence of its substance it has no being, and hence does not of itself occupy space. All space-filling existence is substance; all existence which does not of itself fill or occupy space is not substance. What more perfect definition can there be than one which exactly describes the thing defined, and distinguishes it from everything else? Of every mass of substance which occupies space, and has extension, form, and size, every person can have a clear and satisfactory conception.

Having obtained a clear conception of substance, we say that that substance which has weight, inertia and impenetrability we call matter. We may define matter, then, as substance which has weight, inertia, and impenetrability. There may be substances which are not subject to the force of gravity, and which have no inertia, and which are penetrable to other substances. Such substances are not matter, but immaterial substances. Weight, inertia, and impenetrability distinguish matter from immaterial substance. Weight is also taken to be a correct measure of the quantity of matter.

In regard to the ultimate structure of matter there are

a variety of opinions. I will mention some of these theories here, not for the purpose of discussing them, but that we may have them before our minds, and that others may know what we mean when we refer to them.

Boscovich is credited with a theory which makes each atom of matter a resisting center of force. According to this theory the material universe is made up of resisting centers of force. There is nothing in the universe but force. In this theory there is the same indefiniteness and vagueness in regard to the meaning of the word force, or what force is, which pervades so much of modern science : we are not told whether he means by the word force a substance or an attribute.

Dr. Laurens P. Hickok, in "Creator and Creation," brings forward another theory. According to this, in creation the divine will went forth in action. An action necessitates a reaction. Hence two divine energizings went forth in opposite directions, producing a revolving sphere of energizing. Each one of these spheres is an atom of matter. These atoms, or revolving spheres of the divine energy, become in a sense objective to God, and persist in indestructible existence, and perpetual activity. The material universe is made up of such atoms.

Dr. Herman Lotze, of Germany, suggested a theory a little different from this. Like Hickok he has each atom a sphere or point of divine energizing, but these atoms never become in any sense objective to God, never have a separate or self-perpetuating existence, but are perpetual divine energiznig. Each atom of the material world is a constant divine energizing.

Sir William Thompson, of Scotland, has proposed still another theory of matter. According to this theory each atom of matter is a revolving portion of the supposed universal ether. When the ether is at rest, we can live

and move around in it and not be conscious of its presence; but when certain motions are started in it, it becomes impenetrable and tangible. When the motion is of one kind, it is one kind of matter; when the motion is different, it is another kind of matter, and so on.

All these theories come so in conflict with the evidence of our senses, and are so contrary to the conclusions reached by mankind in all ages from observation, that only the most conclusive and indubitable proofs could render any one of them rational or acceptable to the mass of mankind. No such indubitable proofs have been presented. If we say with Lotze, and all other idealists, that our senses can give us no knowledge whatever of the material world, that all we know is our own thoughts and mental states, of course, we may form any opinion or theory we please respecting the nature of that unknown something which we call the material universe. Shut up to our own thoughts, or, as phenomenalists, to the shadows that float before our minds, we are shut away from all contact with matter and the worlds, and we can sit and dream of what is beyond ourselves, and weave our somnambulic visions into any form we please. Remember that the first step in the formation of these theories is to say, We know nothing of the material world through our senses.

But if we take our senses as guides, and believe that things are as our senses give them to us, no one can believe that any of the foregoing theories of matter are true. We know that in some instances the opinions we form immediately through our senses alone are not true, and we have to correct them by processes of reasoning, but those processes must be based upon facts, and not upon some theory we have formed respecting that unknown something which we suppose to be outside of us. The question is: What opinions or theory of matter best

accord with observed facts, with what we know of matter through our senses? Take the facts as we discover them to be, what must be our opinions of matter? When this is the question before us, and we take observed facts as our premise, I think no rational being will take any of the foregoing theories of matter in preference to the old atomic theory.

We return then to the atomic theory of matter. This theory supposes that matter is composed of ultimate particles which cannot be further practically divided. They are hard, solid bodies. If a solid or liquid elementary substance is vaporized by heat, its atoms are separated from each other, but each atom retains its structure and form, as solid and compact as ever, a minute solid body. The atoms of an element are not susceptible of any change in properties or structure or size by any means known to man. The atoms of the same substance are always of the same size. The atoms of different substances vary in size. All the properties of any substance inhere in each of its atoms.

If two or more atoms of the same substance or of unlike substances unite together chemically, the resulting body is called a molecule. If the atoms are of the same substance, there is no change in their chemical properties —it is still the same elementary substance. When two or more atoms of different substances unite chemically and form a molecule, many of the properties of the two constituents are lost, and a new substance with new properties is formed. If two substances chemically unite, they unite atom to atom. If further union is effected, the number of atoms of one or both the constituents is doubled, or trebled, or quadrupled. When two atoms unite, one of each of two different substances, a compound with one set of properties is formed. When one atom of one constituent, and two atoms of the other unite, a substance

with other properties is formed, and so on. The smallest particle of a compound substance is a molecule. If a molecule is divided, it is chemically decomposed, resolved into ultimate atoms.

All modern chemistry is based upon this theory of matter. If any other theory should be adopted an entire reconstruction of chemistry would be necessary. This is the simplest, and to common observation the most rational theory of matter. But it alone cannot account for the actions and reactions which appear to be going on in matter. It is to account for these that those other theories of matter have been proposed. But there are ways of explaining these activities which allow us to retain this natural view of matter. Scientists, while holding to the atomic theory, have endeavored to account for the activities in matter in three different ways, or by three different theories. We see that matter is to a very large extent in motion. Atoms appear to act upon other atoms, molecules upon other molecules, and masses upon other masses. Now the question is: How can we explain these activities? What is the mover or movers in these cases? In answer to these questions three theories have been proposed by scientists.

One of them is that energy is a persistent, indestructible something which is forever working on in matter, an unchangeable quantity of energizing. Its advocates do not tell us how it came to be. Many of them, after the teaching of Comte, do not think it the business of philosophy to inquire into the origin and cause of things. On coming to years of understanding we find ourselves in the midst of a universe of moving matter. We are not to inquire how it came to be, but only what is the mover? This question is answered by saying that moving matter coming against other matter moves that, and that moves other matter, and so on, The power of moving matter to

move other matter, is called energy, or sometimes dynamic or kinetic energy. This working energy is indestructible, and remains always the same in quantity on earth, except as it is dissipated away in space in the form of heat and light. When bodies of sensible size are moving, it is called molar motion. When bodies of insensible size—atoms and molecules—are moving, it is called molecular motion. This working energy may change from masses to molecules and from molecules to masses, from molecular to molar motion, and back again, remaining unchanged in quantity. This working energy may change from one to another, and another, and another form of working energy, or mode of motion; its quantity remaining forever the same. When molecular motion appears in one form, it is called heat; when it appears in another form, it is called light; when it appears in another form, it is called electricity; when it appears in another form, it is called magnetism, and so on. Thus moving matter is the worker, doer, in all natural phenomena, and is supposed to account for all the motions, changes and doings in the universe. This is the original dynamic theory of matter.

According to this theory moving matter is the mover. What moves the matter? Moving matter. What moves that matter? Moving matter. Matter moves; therefore it moves. It is simply a declaration of the fact that matter moves, without any attempt to give a cause of motion, or a mover, or a doer. Those who elaborated this theory did not pretend to go behind appearances for the cause, or doers. And yet a great many who were not phenominalists have thought that this was an explanation of natural phenemena. Let us see. *No motion without a mover. No doing without a doer.* This theory assumes the self-perpetuating power of motion. But no one claims that the quantity of motion always remains the same on

earth, hence the introduction of potential motion, or motion that may be. Then the theory assumes that dynamic energy is a self-perpetuating power and doer, transferable and communicable from one body to another. Here again our absolute truths come in. Dynamic energy is not substance. *Nothing but substance can be moved in space, or transferred from one place to another. Nothing but substance can be a doer.* Then, as dynamic energy is not substance, this whole system of dynamic philosophy is thrown out at once. As we find that this theory violates absolute truths, we may drop it and throw it away as worthless. But as those who planned this theory, before proceeding to their work, threw out all absolute truths, and proposed to proceed without their intermeddling, and will not admit them as testimony, we will hereafter consider it in the light of facts.

The palpable weakness and insufficiency of the foregoing theory led to the construction of another theory, or it may be considered only a modification of this. This new theory, like the former, holds that moving matter is the mover and doer in nature; but it endowes atoms and molecules with a self-moving power, power to start themselves in motion. They do not move merely when moved by something, but they move of themselves. Their normal state is that of motion. It is their nature to be forever moving. Some external agent is necessary to stop them, rather than to start them. If they are stopped by something external to themselves, as soon as the obstruction is removed, they commence their motion again.

This theory supplies a mover, which was lacking in the former theory—that is, it gives to molecules the power to move themselves. But it fails to supply changers. What changes the mode of motion from gravity to heat, and from heat to electricity, and from heat to life, from attrac-

tion to repulsion, and so on? "Why, physical conditions, of course." But when we undertake to find those physical conditions, and trace them out in each particular case, all we have to say is that we cannot find them. In a few cases men have found something which might possibly answer as reasons for the change; but if they were satisfactory, they were so only because they wished to find them. Some men are still holding on to this theory, in hope that some changers may yet be found or thought of.

Finding it impossible to discover changers, another theory has been devised, or the original theory has undergone another modification, returning to the old Lucretian doctrine of Atoms. This theory endows molecules, not only with the power to move themselves, but also with the power to change their own mode of motion as occasion may require. They are made competent to do all that is done in nature. What becomes actual, was before potential in the molecules. The phenomena of the universe flow on as a necessary succession, a necessary order of sequences. The antecedents which would necessarily result in the present, existed in all molecules in all past time. Thus all the phenomena of the universe are explained by assuming that the molecules are competent to do the work. That the molecules are the doers, is assumed, and then the occurrence of the phenomena is supposed to show their competence. Something does these things; we assume that molecules are competent to do these things; therefore these phenomena are the work of molecules. There is no other evidence that such is the nature of molecules, but we will put into their nature all that is necessary to enable them to work out these results.

Of course, this theory is theoretically competent to explain all natural phenomena, all the activities found in nature. Whatever doing we discover we can assert the competence of molecules to do. If some new and

wonderful doings are discovered, beyond the ability which we have hitherto assigned to the molecules, we only have to load up our molecules with new powers to make them competent. If we would account for the appearance of sensation in nature, we can assert the competence of molecules to produce sensation, or even that the molecules themselves possess sensation. If we see the manifestation of intelligence in nature, we can assert that molecules possess the power to produce intelligence, or that they have the power to act intelligently, and with a plan and purpose. There is no power that we may not theoretically attribute to them. This theory, then, can be tested only by a practical examination of natural phenomena, to see if molecules do really possess these powers, and to see if it is possible that molecules should perform all these doings. Absolute truths demolish at once the original dynamic theory of matter, and also that modified form of it which gives to molecules the power to move themselves. But in reference to the bare assertion that molecules are competent to do all that is done in nature, absolute truths can say nothing.

But in the practical application of the theory to actual phenomena, we find that most natural phenomena are produced across intervals of space, in portions of space other than that which the molecules which are supposed to be the doers occupy; and then an absolute truth comes in to limit our freedom of supposition—*nothing can do where it is not*—and we are commanded with an imperative voice to halt; and we find that our theory is utterly impracticable and impossible in its application to actual phenomena. Whatever powers we may give to molecules, *they cannot do where they are not.*

Well, after carefully examining all other theories of matter, and candidly weighing the evidence presented

in their support, we are back to the old passive "lump" theory of matter, as it is sometimes deridingly called. The explanation of the activities in nature according to any purely physical theory are entirely unsatisfactory, even impossible, as we have seen. The arguments in favor of the theory of Lotze are based upon the supposition that all our knowledge of matter is dynamic, and that action between molecules is action between separated bodies; and as I admit neither of these premises of the arguments, they have little weight with me. Our senses very positively declare to us that matter is hard, solid substance. If we rely at all upon the evidence of our senses, this is the fact. It needs something more than an hypothesis, devised to account for the activities in nature, to overthrow this evidence of our senses, especially as there are ways of explaining these activities which do not conflict with sense appearances.

We will now consider some further suppositions respecting matter.

It is supposed that the molecules of matter are always detatched bodies, and are never in contact, not even in the most dense liquids and solids. It is admitted by all that the molecules of gases are separated from each other by intervals of space. It is claimed that the same is true of the molecules of liquids and solids, only that the spaces between them are less.

We know that according to our senses the molecules of liquids and solids appear to be in contact. The permanent form, the sharp angles and polished surfaces of solids indicate that these appearances are true. It does not seem possible that sharp angles and polished surfaces should remain permanent and unchanged through many years, resisting so strongly influences which tend to disturb them, if the molecules are detached bodies in constant motion. The great power which is necessary

to move these molecules, and with which they resist efforts to separate them, seems inconsistent with this supposition. In all cases where the molecules are known to be detached—in gases and vapors—they are easily moved among each other, and easily separated. We cannot see why this should not be the fact in all cases of detached molecules. Indeed, it would seem that we might say that it must be so. On a point which seems so plain and certain, only the most positive testimony can set aside these considerations and the evidence of our senses. What proof is there that the molecules of liquids and solids do not touch each other? No doubt many will be surprised when they see the meager proof by which this opinion has been made current and almost universal among scientific men.

First, it is ascertained by experiment that all liquids and solids are compressible. This proves that either the molecules are separate, or that, touching at points or surfaces, like round bodies, they have interstices of unoccupied space among them. Either of these facts satisfactorily accounts for compressibility. We know that a mass of bodies—as a barrel of apples—is compressible, because, though the apples may touch each other, there are interstices among them. This seems to be the most rational explanation of compressibility. Water is so little compressible that for many years it was thought to be entirely incompressible. Yet if water freezes it occupies more space. The agent which is supposed mainly to keep the molecules apart, heat, has been greatly diminished in it, yet it cannot now by any means be compressed into the same space that the same matter occupied as water. Have the molecules been moved farther apart, or have they been arranged in crystalline forms which leave larger interstices among them?

Another reason for supposing that molecules do not

touch each other is this: Heat is supposed to be molecular motion, and there is some heat in all bodies, and the molecules must be separated to allow of this motion. A theory is supposed, and facts are made to conform to it, or are deduced from it. Is that the inductive method, which scientists declare to be the only allowable one in science? Facts must determine theories, and not theories facts.

Again, the supposed ether, in order to accommodate other suppositions, must be supposed to pass through all material bodies; hence there must be supposed to be intervals between their molecules. If there were a few more suppositions in this argument, it might possibly become a supposed proof.

These are the evidences that the molecules of matter are separated by intervals of space. Is it not strange that an opinion so meagerly supported, without one discovered fact to sustain it, should be regarded as a settled doctrine in science? These proofs are entirely insufficient to set aside the evidence of our senses and the other considerations mentioned.

Then while this supposition accommodates some theories, it greatly increases the difficulties of others, and renders the explanation of natural phenomena in many respects more difficult. Action between separated bodies through intervals of space, has always been the most difficult problem in nature to solve, and it has defied longest the ingenuity of man. If we suppose molecules to be separated bodies, we greatly increase this difficulty, we make all the doings in nature action between separated bodies. If it was before impossible for scientists to explain how the earth and moon could act upon each other, it now becomes equally impossible for them to explain how one atom or molecule can act upon another, and over all natural phenomena we have spread the shadow of an impenetrable mystery. I believe that

the molecules of liquids and solids are in actual contact.

There are one or two other forms of matter that we must notice. We have spoken of matter in a liquid and solid state. We know that some matter exists in the forms of gas and vapor. We have concluded that the molecules of liquids and solids are in actual contact. But the molecules of gases and vapors we know to be detached and separate. The question now is, By what means are they kept apart?

A theory has been devised by which the molecules of gases and vapors are said to keep themselves apart. Their molecules are supposed to be in motion, flying about and knocking against each other, and this knocking tends to drive them apart, and enlarge the volume of the mass. This is a part of the dynamic theory of matter, which has an undiminishable stream of dynamic energy running through the world, passing from one body to another, etc.

This theory of expansion is contrary to all appearances received through the senses. But in speculative science, though we are forbidden to use any other evidence than that received through the senses, little importance is attached to that here.

But this theory involves some impossibilities. If molecules are little bodies of matter, they are subject to the laws of motion as found true of other bodies of matter. We know from experiment that flying bodies of matter can be stopped; and that if they are stopped, when the obstacle is removed they do not resume their motion again. Reduce a gas by cold and pressure to a liquid or solid. The molecules no longer move as flying detached bodies; they have no velocity. Remove the pressure, keeping the temperature the same. Without any impact from anything outside of themselves, they immediately rise up and commence their flying again, with the same velocity they had before they were stopped. Bodies of matter that

have been stopped do not start themselves in motion again. Matter does not perform such doings as this. Other evidence will be given in the chapter on motion.

But according to that form of the dynamic theory of matter which gives to molecules the power to move themselves, and, if they are stopped, of starting themselves in motion again, cannot this theory of expansion be maintained? Certainly; and according to that theory there is no need of supposing any knocking at all, or any motion. We can just as well suppose that molecules have power to hold themselves at a certain distance from their neighbors without motion, as to suppose that they have power to start themselves in motion after having been stopped. After we depart from all basis in discovered facts, we may suppose anything we please, anything that will favor our theory; we are on the wing, and there are no limits to our supposing, except our power of flight. This theory of expansion by molecular knocking is of no use at all, except in the original dynamic theory of matter.

There is still another supposed form of matter to which we must give attention. I mean what is called the luminiferous or universal ether. The supposition is that all siderial space is filled with a gas made up of particles so fine and so far apart that it presents no obstruction to the worlds passing through it, and that light and radiant heat are waves or vibrations in this gas or ether.

I am not able to receive this hypothesis as true, for the following reasons: In the first place, it seems to be an awkward and laborious way of transporting light through space. It is an attempt to conjoin that which is weightless as thought, and swift as thought, with slow and cumbrous matter. It is like harnessing as two steeds the lightning and the glacier. The result must be to reduce light to the conditions of matter, or to exalt matter to the conditions of light. But certain facts respecting light

have been determined, and certain facts respecting matter have been determined; and these two classes of facts are as incompatible as light and darkness. Either we must give up the known facts of light, or else the known facts of matter. Scientists have elected to do the latter, and have supposed a form of matter which is unlike all other matter, and which cannot be held to, or tested by, the known laws and properties of other matter. A theory which carries us into such a wide departure from all basis in the known, and which is obliged to supply so much from imagination that is unlike the known, has a reasonable presumption against it to start with.

Then, after we have supposed such a medium for the transmission of light we have provided for only one of the many mysterious relations existing between the earth and the sun. The supposed magnetic and electrical influences of the sun upon the earth, and the known attraction of the earth by the sun, remain still unexplained. Such a medium could not be used by the sun as a line with which to draw the earth from a straight line into an orbit. Certainly some medium is as needful for this work as for the transmission of light; and it is equally certain that a rare gas, whose particles are struggling to get further apart, could not be used for this purpose. Nothing can do where it is not, or outside of its own limits; then some medium must fill this intervening space, through which this work is performed. The sun appears to perform several different kinds of work upon the earth. This supposition of an ether attempts to explain one of them, and does not profess to explain the others, when there are other suppositions that will satisfactorily explain them all. Why should such strained and desperate efforts be made to overcome obstacles and surmount difficulties, making successively new and multiplied suppositions, imagining something

which is unlike everything else in the universe, to maintain this hypothesis, when other suppositions require no such labored effort, and meet with no such difficulties, and are easily satisfied with only the known materials of nature?

When the thought of such a medium was first suggested the question was not, is such a medium possible? but, supposing it to be, can optical phenomena be explained by it? At that time the properties which the medium must possess to render it competent for its work were not so well understood as they are now. It was easy to suppose that the inter-stellar spaces were filled with a gas so rare that it would be no obstruction to the planets in their orbits, and that it might be a medium for the transmission of light; but when men came to inquire what its properties must be to enable it to convey light at the tremendous velocity of 185,000 miles in a second of time, the real difficulties in the case began to be apparent.

It was agreed by philosophers that the velocity of vibrations in any medium depends upon the rarity and elasticity of the medium. To increase the velocity there must be less matter in a given space, or the resistance to pressure must be greater. Ascertaining a rule by experiments with gases of different densities, it was decided that in order to attain the velocity of light, the elasticity of the ether must be at least 1,000,000,000,000 times the elasticity of the air at the earth's surface. Now let us understand what this means. These numerals are the measure of the resistance of the ether to pressure, and the measure of the pressure of the ether upon bodies that are in it and upon the surface of the earth. Its resistance to pressure is greater, then, than an ordinary solid. If the pressure of the atmosphere upon the earth is fifteen pounds upon every square inch, the pressure of this ether is 15,000,000,000,000 pounds upon every square inch of

surface: "Equal," says Prof. J. P. Cook, Jr., in New Chemistry, "to the weight of a cubic mile of granite rock." There are on an average man's body at least 1,500 square inches of surface; then each of us is living and moving about under the weight of 1,500 cubic miles of granite rock.

Then, the two requisites of great velocity—rarity and great resistance to pressure—when carried to such an extent, seem inconsistent and contradictory. Reduce the quantity of matter in the ether to the requisite extent and there seems to be practically almost nothing left. and yet if a cubic inch of it could be confined to its inch of space, and a cubic mile of granite rock were placed upon it, that pressure wonld not reduce it to smaller dimensions.

Then the question arises, if its particles are so fine and so far apart that there is only this amount of matter in it, what keeps its particles apart with such tremendous power that a cubic mile of granite rock pressing upon a single inch of it cannot drive them nearer together? Shall we apply to it the dynamic theory of gases, and say that its atoms are kept apart by the momentum of their own motion knocking against each other? Who can believe that the particles of matter where they are so fine and so far apart that there is no more than one one-hundred-millionth as much matter there as there is in the same space of common air, could have sufficient momentum to lift a cubic mile of granite rock? (These suppositions of science make prodigious demands upon our marvelousness and credulity.) If its particles have this tremendous momentum, they would tear in pieces the hardest steel body that they might come in contact with, and a wave or vibration passing through them and striking upon the earth, would be equal to the explosion of a ton of nitro glycerine. If

their motion be supposed to be the motion of heat, the temperature ought to be a million times greater than any temperature known to man. If we suppose that the molecules of a gas are held apart by an invisible force called molecular repulsion acting between them, and apply this to the ether, we find that its atoms are held apart millions of times more strongly than the molecules of any known gas. It cannot then be the same force as that which operates in gases, and to maintain our former suppositions we must make still another supposition, and suppose another, a new and otherwise unknown force, of far greater power than any force known on earth.

The particles of this immensely rare gas are held apart so strongly that the space occupied by it is really filled with a solid. Although there is comparatively almost no matter there, yet the particles that are there are held apart with as much power as they would be if the spaces between them were filled with ordinary matter. Hence the ether really becomes a solid, and it is so described and named by scientists. Sir William Thompson thus speaks of it: "This luminiferous ether is an elastic solid. It is matter millions of times less dense than the air, but possessing the most prodigious rigidity in proportion to its density." Professor Tyndall, more cautiously, perhaps lest he should too violently shock the prejudice of his readers, calls it a "jelly," or "more like a solid." Dr. Thomas Young, who is credited with more agency in making the undulatory theory of light acceptable to mankind than any other man, says: "The luminiferous ether, pervading all space, and penetrating almost all substances, is not only highly elastic, but absolutely solid." (Young's Works, vol. 1, p. 415, quoted by Jevons in Principles of Science, second edition, page 515.) Professor Jevons

himself, says on the same page: "Herschel calculated the force which may be supposed, according to the undulatory theory of light, to be constantly exerted at each point in space, and finds it to be 1,148,000,000,000 times the elastic force of ordinary air at the earth's surface, so that the pressure of the ether per square inch must be about seventeen billions of pounds. Yet we live and move without appreciable resistance through this medium, immensely harder and more elastic than adamant."

Here are four or five men of the very highest authority in physical science, who declare that this ether, that it be capable of transmitting light at its known velocity, must press upon the human body with a weight of billions of pounds to every square inch of surface, must be an "absolute solid," "prodigiously rigid," and "harder than adamant." Let me ask you, reader, are you living and moving about under the pressure of a good sized world, and through a medium that is harder than adamant? You may not have obtained membership in the guild of professional scientists; but have you therefore no common sense, no power to see and know? and must you form no opinion but such as professional scientists give you? Standing upon the bare surface of a granite rock, let them tell you that the rock upon which you stand is softer than the matter which invests your body, that the space above the rock, the space through which you move, through which you move your legs and swing your arms, is filled with a solid "harder" and "more rigid" than the rock upon which you stand, and believe them if you can!

But the greatest difficulty of all remains to be mentioned. If the inter-stellar spaces are filled with an absolute solid, harder than adamant and of prodigious rigidity, how are the worlds to pass through without

obstruction? To obviate this difficulty some have supposed that the ether has no weight nor inertia. Then it is not matter, it lacks two of the three essential characteristics of matter, which distinguish it from immaterial substance, and it belongs to the class immaterial substances, rather than to the class matter. To this supposition other scientists answered that if it has no weight or inertia, no vibrations can be transmitted through it. Without gravity one body hitting another would have no momentum to move the hit body. Without inertia no body would move any farther than the push of the hitting body. Because of these considerations these suppositions were discarded. The attempt was made to obviate this difficulty by supposing great mobility among the particles of ether. But the properties of mobility and rigidity are a contradiction. That which distinguishes a solid is its rigidity, or absence of mobility. We must give up either its rigidity or its mobility. If we give up its rigidity, it cannot answer the purpose for which we supposed it to be. If we give up its mobility, the worlds cannot move in it. We must not give up the theory; therefore we must hold on to its rigidity. Then we have the planets whirling around the sun at the rate of a thousand and more miles a minute, through a hard, rigid, absolute solid, and meeting no resistance?

If we admit that the ether is solid, we have to change our views of the form of the waves or vibrations. Waves in an aerial substance consist of successive alternate denser and rarer portions of the medium. Vibrations in a solid are transverse deviations from a straight line, as vibrations run along a taut wire. Vibrations in a solid cannot be transmitted through it unless its molecules touch each other or are held together by cohesion. When one atom moves to the right or left of a line, it cannot move any other atom in that line, unless it touches or is

bound to it by cohesion; and the degree of elasticity depends upon the firmness with which the atoms are bound together. As this supposed ether transmits vibrations millions of times more rapidly than a steel wire, the best conductor of vibrations known, the atoms of this ether must be bound together with millions of times more strength than the molecules of a steel wire; and yet we have the worlds passing through it without meeting any resistance or obstruction.

It would seem that by this time we ought to abandon this hypothesis altogether, and contrive some other way for getting light from the sun to the earth. But no; we have espoused this theory, and we will not retreat, but will go on, making new and more wonderful and wilder suppositions, and plunging into deeper and ever deeper absurdities. We will conclude that, after all, we know nothing about matter, and can therefore project from it no limitations to theorizing or possibilities; it is only appearances anyhow, and may not be anything like what we suppose it to be; and after we have gone so far, we have run ourselves out of all science and all philosophy for the sake of maintaining a theory. It has been suggested that this supposed ether embraces all there is of science and philosophy, and that it is all there is of the material universe, and that the worlds and all things therein are only different forms of this ether, and all that mankind in the past have thought to be knowledge was only delusions.

Of course, if matter is only resisting centres of force, which may take on or lay off their resistance according to circumstances; or if matter is only points of the divine energizing, which may resist or not resist at the pleasure of the energizer; or if we suppose matter to be only different forms of motion in the universal ether; if we set ourselves in any way to construct a purely imaginary

system of the universe, we may suppose that in certain circumstances matter is not impenetrable, and that worlds may pass through the hardest and most rigid matter without encountering any resistance, or make any other supposition we please; but if we are to erect our edifice upon discovered facts and the known properties and laws of matter, if we are to give any validity to any knowledge obtained through the senses; we must pronounce the existence of any material medium, filling the entire space of the solar system, capable of transmitting vibrations at the known velocity of light, and at the same time offering no resistance to the revolving planets, a direct contradiction and an utter impossibility.

These considerations explain why some great and learned men hold on to this hypothesis in full view of all these apparent absurdities and contradictions; for I would not for a moment intimate that these difficulties and contradictions have not presented themselves to these men. The great and learned are subject to prejudices, as well as any others. When such a man has championed a theory, and devoted all his energies to its maintenance, if some great obstacle rises up before him, which peremptorily stops him and defeats him, he does not propose to acknowledge defeat or turn back, but he bends all his energies in effort to overcome the obstacle. Thus men have adopted the hypothesis that light is conveyed from the sun to the earth through a material medium, and that light is vibrations in this medium, then when it is discovered that, according to all known properties and laws of matter, this is an impossibility, instead of discarding the hypothesis, as would seem most rational, they begin to make suppositions respecting the nature of this medium, make it unlike all other matter, deprive it of the properties essential to matter, endow it with properties found in no other matter, assign to it

laws which are a contradiction to the laws of all other matter, and which in the different parts of the theory contradict each other, and still hold on to the hypothesis. Nor is this all, but returning from these regions of imagination, they tell us that the supposed facts of sensible matter are all wrong, and from the properties and laws with which they have found it necessary to endow their ether, that it may be able to accomplish what they desire of it, they would correct our concepts of sensible matter and require us to receive as established science the visions which float in the fields of imagination. It appears to me to be time to call a halt, and return to terra firma, and start again from the foundations of the known, and to discard a theory which has hard, solid, prodigiously rigid matter which is no hindrance to our motion in it and no obstruction to the passing worlds.

Yet, notwithstanding all these wonders and difficulties and contradictions, scientists tell us that we must believe all this, and receive this as the true theory of light. Why? Because many optical phenomena can be explained by it; because it will explain optical phenomena better than Newton's corpuscular theory. If we were shut up to the alternative of believing in Newton's theory or this, we might consider which of the two impossibilities we would try to endure until something better should be presented. But we are not thus limited to these two theories. Facts show that Newton's theory is false and impossible. Facts, even the facts which have been mentioned in these pages, show that this theory is false and impossible. What is needful for us, then, is not to try to swallow either of these absurdities, but to look for some other theory which is not an absurdity. We shall see in future pages that another supposition respecting the nature of light is possible, which will explain optical phenomena more perfectly

than this, and which meets with none of the difficulties, contradictions, and impossibilities which overwhelm this.

PROPERTIES OF MATTER.

We defined properties as inherent characteristics of substance. Many attributes which in both popular and scientific language are called properties are not included in this definition. An accurate classification requires at least three terms to designate the different things which have been called properties. The old division into primary and secondary properties is not enough. In the first class we would place certain necessary facts respecting bodies: location, extension, form and size. These are absolute facts respecting all bodies. These may be denominated necessary properties of bodies. In our second class we would place those characteristics of material substances as masses, which result from the action of the natural forces in them and on them; such as weight, color, hardness, softness, elasticity, ductility, solidity, fluidity, etc. These are consequent upon the action of the forces of gravity, light, cohesion, molecular repulsion, and heat in and on the substances. We may, according to popular custom call these properties, but it should be understood in what sense we use the word. A proper term to designate these would be contingent properties. In our third class we would place those characteristics which permanently inhere in the substances, the real properties, according to our definition, such as impenetrability, indestructibility, sweetness, sourness, bitterness, and a thousand others, many of which have never been named. We have, then, necessary properties of bodies, contingent properties, and properties of substances.

Some of these real properties of substances are discov-

ered immediately by the sense of touch, taste, and smell. The mind in immediate contact with substances perceives certain of their properties. There is a certain real property in some substances which we perceive through the sense of taste and call it sour. The statement that this is only a name of a sensation is, in my view, not correct. This was the statement of the case according to the theory of mediate perception. But if we immediately perceive anything, this is one of the facts in that substance which we immediately perceive. All of the real properties of substances, except impenetrability and those which are perceived by the senses of taste and smell, are discovered only by the results of the action of the forces in and on them. They are not, like contingent properties, consequent upon the action of the forces, but they are discovered by this means.

Some of them are discovered by the action of light upon matter. The properties of one subject are such that when light falls upon it, all the light enters it, and we call it a black body. The properties of another substance are such that when light falls upon it, all the light turns away from it, and we call it a white body. The properties of another substance are such that when light falls upon it, all the light enters it, except the red rays; they turn and fly away from it, and we call it a red body. The properties of another substance are such that when light falls upon it, all the light enters it, except the blue rays; they turn and fly away from it, and we call it a blue body, and so on. Thus the different results of the action of light upon different substances are consequent upon certain properties existing in those substances, which properties can be discovered by no other means.

We discover another set of properties by the action of heat upon different substances. One substance is said to reflect more of the heat which comes against it. Another

is said to absorb more. Another is said to radiate heat more rapidly. Some are said to be conductors. Some are said to transmit radiant heat, and others not. There must be some different properties in these substances which are the conditions of these different results of the action of heat upon them. The different results must be consequent upon varying properties in the different substances. What those properties are, and that they are, we can know only by the results of the action of heat in contact with them.

Another set of properties is discovered by differences in the doings of the vital forces in their presence. One substance taken into the stomach results in perspiration, another in emesis, another in catharsis, another in diuresis. These substances must all have different properties which condition these different results, or in the presence of which the vital forces act thus differently. These have been called medicinal properties. That they are, and what they are, we can ascertain only by experiment and the results.

We present these cases as examples of the manner of the discovery of properties by the action of the forces on matter. In none of these cases does the matter act to produce the results. The matter does not act upon the light to cause it, in one case to enter in, and in another case to fly away. The light is the only doer in these cases. The matter does not act upon the heat to produce the diversities in the results. The heat is the only doer in these cases. So likewise, the medicinal substances do not act upon the animal system, except where the chemical force in them decomposes the tissues. The vital forces are the doers in these cases. Other properties are discovered by the action of other forces on matter, but these are sufficient to show the manner of discovery.

CHAPTER V.

FACTS AND THEIR TEACHINGS.

Before proceeding to the examination of facts we must understand the signification we attach to certain words. In our experience we find that bodies at rest do not start themselves in motion, and that an exertion of energy is necessary to start them in motion. We find also that an exertion of energy is necessary to stop the motion of a moving body. We learn from this that motion is never practically separated from energizing. Wherever there is motion there is energizing, either to start it or to continue it. Energizing is necessary to start the body in motion, and there is constant energizing in it to continue its motion. Motion is always dependent upon energizing for its existence. There is no motion without energizing to produce it; and if there is energizing, there must be an energizer.

The energizer we call a force. By the word force we mean something which energizes to produce motion, or to prevent motion, to produce or prevent change. To produce motion, is to produce change; and to produce change, is to produce motion, stop motion, or alter the direction of motion. We have designated that which produces change by the word doer. Force and doer, then, are synonymous terms, except that a force may energize without producing motion, and even to pre-

vent motion; but a force is a doer only when it causes motion or produces change. All doers are forces; and as a force is that which produces motion or effects change, and as a doer is that which produces motion or effects change, and as the word forces includes everything that does produce motion or effect change, the word forces includes all doers. We do not here state by what other names some of the forces may be called, whether the specific names of the inorganic forces, or matter, man, or God, but everything which produces motion or effects change is a doer and a force, and there are no doers but the forces.

Now we advance another step. All doers are substance; all doers are forces; then all forces are substance. Nothing is a doer or a force that is not substance. If we talk about motion without a mover, or about doings without a doer, or about movers, doers, or forces that are not substance, we are talking nonsense. This does not determine whether the forces are material or immaterial substances; but they are and must be substance.

According to this definition of force, it is not proper to say The man has great force, but rather, The man has great energy. It is not proper to say, The cannon ball moves with great force, but rather, The cannon ball moves with great power. It is proper to say, The force of gravity, the force of electricity, the force of inertia, and so forth; and we mean by such expressions the substance which is called gravity, inertia, etc. We do not mean by the force of gravity, a law, or a mode, or a class of phenomena, but a substance which is and does. There is something which energizes to pull bodies down to the earth, and that something is substance, and to that substance we give the name gravity. There is something which produces the motions attributed to heat, and that something is substance, and to that substance we give

the name heat. There is something which energizes to hold matter at rest when it is at rest, and to continue its motion after it has been started, and that something is substance, and to that substance we give the name inertia. There is something which energizes to cause the motions attributed to electricity, and the motions attributed to magnetism, and the motions of light, and to hold molecules together in masses, and to place molecules together in the form of crystals, and to unite atoms and molecules chemically, and to push molecules apart; and in each case that something is substance, and to the substance which is the actor or doer in each case we give a specific name. These are what are called the inorganic forces. There are ten and, it is thought, only ten of them. This does not say whether they are material or immaterial substance, but they are substances. If they are molecular motions, or molecules moving, those molecules are substance, and to molecules in a particular form of motion we give a specific name. If they are the divine substance energizing, they are substance, and to the divine substance in a particular form of energizing we give a specific name. Now let us use the word force in this sense, and in no other.

Here we have been using the words energize and energizing. No one has been at a loss to know what we meant by those words. We all know that we energize, and that we effect changes in matter by energizing. This thought is familiar to us, both in our language and our experience. We know the meaning of these words, and they have fixed and uniform significations. We energize, we exert energy. We all know and all say that we exert energy. What do we mean when we so speak? We mean that we exert or use an inherent characteristic of ourselves, a property of ourselves, when we produce motion. We call that property of ourselves energy. All men call

it energy. It has been called energy during the ages. What do we gain now by departing from this usage, and constructing a definition conformed to, or derived from, a theory, a definition which, if our theory turns out not to be true, will only stand as a monument of our folly? That which we are conscious of using or exerting to produce motion or to prevent motion we call energy. We know it in our consciousness as a property of ourselves, an inherent characteristic permanent in ourselves, whether we use it or not, which we may use or not use. If from sickness, or any other circumstance, we become incapable of exerting energy, we find that we can do nothing, move nothing,—we are partially or wholly deprived of that property which we did possess which we call energy. Our ability to effect changes in matter depends entirely upon the amount of this property in us available for use. We may, then, define energy as that property of some substances which enables them to do or to effect changes in matter. Then no substance can be a doer or a force, unless it possesses the property of energy.

In all cases of physical motion the matter itself must possess the property of energy, and be able to start itself in motion, and to perpetuate its own motion; or else there is some other substance in it which does possess the property of energy and moves it; or else something outside of it is acting upon it and moving it. It requires the exertion of the same amount of energy to continue the motion of a moving body as was required to start it in motion. This is evident from the fact that it requires precisely the same amount of energizing to stop it as was used in starting it. If there was no energy exerted to continue the motion, no exertion of energy would be required to stop it. In all flying detached bodies there is as much energy exerted to continue their motion as was exerted to start them in motion.

As in all moving bodies there must have been an exertion of energy to start them in motion; and of as much to continue their motion, and as in all exertion of energy there must be something exerting it, some substance of which this energy is a property; as all motion requires a mover, all doing a doer, and as all doers are substance; the question arises, Is the matter itself the doer? or is there some other substance outside of it acting upon it to move it? These questions involve the question, Is energy a property of matter? In determining whether matter is itself the doer in natural phenomena or not, it will be necessary to examine a number of cases of moving matter to see whether it is possible that matter should be the doer. This we now proceed to do.

We see bodies falling toward the earth. The matter of the earth and bodies do not meet; there is an interval of space between them. Then the matter of the earth can not draw those bodies. This is not merely that we can not see how it could. It is not merely that the phenomena of gravity are yet unexplained. It is that we know that it is not possible that the matter of the earth and body should be the doer in these cases. *Nothing can do where it is not. No substance can do outside of its own limits.* The atmosphere which fills the space between those bodies is made up of detached particles which are struggling to get farther apart, hence that cannot be used to draw with. If there was any other matter in that space that could be used to draw with, we could by its properties of weight, inertia, and impenetrability discover it. We have found abundant reasons for discarding entirely the supposition of a universal ether; but if that space be filled with such an ether, according to any supposition which has ever been made respecting it, it could not be used to draw with. It is impossible that the matter of the earth should do anything to the matter of the

bodies. It is impossible that the matter of the bodies should do any thing to the matter of the earth. Nothing can do where it is not, or outside of its own limits. Then if the process is by attraction, if there is any such thing as the attraction of gravitation, as has always been supposed, matter cannot be the doer in this case. If the process is by attraction, it is impossible that matter should be the doer in any case of motion caused by gravity; for unless bodies are separated by intervals of space, attraction can never cause motion. Then that substance which we call gravity is not matter, or material substance.

The same is true of all other attractions. The opposite poles of two magnets attract each other through intervals of space. Two bodies, one charged with positive and the other with negative electricity, attract each other through intervals of space. Chemical attraction between atoms and molecules acts across intervals of space. Scientists say that it is the falling together of the atoms through these intervals which produces the heat consequent upon chemical action. The crystallizing force attracts across intervals of space, drawing together molecules which are separated by solution. Now, if the process is by attraction, if these are attractions, as they have always been called, it is not possible that matter should be the doer in any of these cases. It is not possible in any of these cases that one body should act upon another across an interval of space. Then if the process is by attraction, that substance which we call magnetism is not matter, or material substance; and that substance which we call electricity, and that substance which we call the chemical force, and that substance which we call the crystallizing force,—none of these can possibly be matter.

We reach similar conclusions in cases of repulsion across intervals of space. The north poles of two magnets, and the south poles of two magnets, repel each

other across intervals of space. Two bodies charged with positive, and two charged with negative, electricity repel each other across intervals of space. The molecules of all the permanent gases are held apart across intervals of space. If the process in these cases is by repulsion, if in any of these cases the one body does have any influence upon the other body, in none of these cases can matter be the doer; and it is not possible that magnetism, electricity, or molecular repulsion should be matter.

There are many other cases of action across intervals of space. In all cases of electrical induction, in all cases of magnetic induction, in all cases of the action of magnetism upon electricity, and electricity upon magnetism, and of magnetism upon magnetism in separated bodies, and of electricity upon electricity in separated bodies,—in all these cases there is action across intervals of space. All of these cases can be classed under attractions and repulsions. If they are attractions and repulsions, if one body does in these cases have any actional relation to the other body, in none of these cases can matter be the doer, and none of the forces here mentioned can be matter.

If there is no material medium between the earth and the sun, as we have abundant reason to conclude, heat and light exist and move in space where no matter is. There is no greater necessity for supposing a material medium between the earth and the sun than between bodies drawn together by gravity, or between bodies in which electrical or magnetic phenomena are manifested, or between bodies drawn together by chemical or crystallizing attraction, or between bodies that are kept apart by molecular repulsions, or, if the supposition of scientists that all molecules are separated bodies be true, between all molecules. And no material medium can be supposed with properties which would answer all these purposes,

and yet allow of these motions. And if there was any material medium in all these places which would answer these purposes, we could detect it by our senses. The only legitimate conclusion to which we are ultimately led by the supposition that the natural forces are physical processes, is that which Sir Wm. Thompson has suggested that the entire universe is a mass of continuous matter; and then all our knowledge is a delusion, and the science and philosophy of the past are fictions. If molecules can act upon each other through intervals of space in the phenomena of crystallization and chemical action, and in electric and magnetic phenomena, and in the work of gravity, without using a material medium, I see no reason why masses, worlds, may not act upon each other through intervals of space without any material medium. There is no more necessity for supposing a material medium for light than for gravity.

We have, then, gravity, electricity, magnetism, the chemical force, the crystallizing force, molecular repulsion, light, and heat, eight of the ten inorganic forces, which are plainly shown to be not matter, not material processes, and we see that what have been called the physical forces are not molecular motions. As the other two of these forces, cohesion and inertia, never act beyond the limits of their bodies, they cannot be thus shown to be not matter.

But now, it may be supposed that these processes are not attraction and repulsion, and that there is no such process as action and reaction among molecules or masses; but that each moves itself, does as it does with reference to other bodies, by its own inherent power, unacted upon by anything outside of itself. This is an old supposition, and has been often answered, but we give it place here. This gives to masses as well as molecules, a self-moving and self-directing power. They must also be capable of

perception, must be able to see the bodies toward which they would move. They must also resolve that, when they move toward other bodies, they will increase their velocity according to a fixed law. They must possess remarkable power to form judgments of distance, or they might make a mistake and start to move toward a body that is at greater distance from them. They must possess great ability to form judgments of size, of the quantity of matter, or they might start toward a body that contained a less quantity of matter. After forming perfect judgments of distance and size, they must possess wonderful mathematical power to calculate the resultant of many bodies around them in all directions. They must possess skill in execution, in marking out straight lines, curves, and circles, far beyond human powers. They must be capable of contemplating purposes and ends beforehand, and great wisdom in the selections of means and ways to accomplish those ends. To believe that molecules and masses of matter possess such wonderful powers requires a degree of credulity that I do not claim to possess.

Unless matter does possess these wonderful powers, molecules and masses, or something else in them, must act and react upon each other. Then matter can never be the doer in any natural phenomena, except where one moving body comes against another body and moves that. In all motions resulting from gravity, electricity, magnetism, the chemical force, the crystallizing force, molecular repulsion, light, and heat, the mover and doer cannot be matter.

We find, then, that the whole of what is called the dynamic theory of matter is included in the doings of the force of inertia. The force of inertia energizes to hold matter at rest if it is now at rest, and to perpetuate its motion if it is now in motion. This is the whole basis of the dynamic theory of matter, this includes all the facts

which support it, and these facts are all there is of it. The other nine forces have their modes of doing, and none of them can be brought under the mode of inertia. The attempt to extend the law of inertia into a universal principle, explaining all natural phenomena, is one of the follies of this age.

The fact that most of the phenomena of nature are effected through intervals of space, where the supposed doer is not, is conclusive proof that matter is not the doer, proof that is equal to a mathematical demonstration, provided it be true that a thing cannot do where it is not. But the reader may think, has not the difficulty of action between remote bodies presented itself to philosophers during all the past, and yet they have gone on admitting the fact of such action? And has not the postulate, which declares that a thing cannot do where it is not, been known to philosophers during the centuries, and yet they have not objected to the physical philosophy which assumes that separated bodies do act upon each other? To these questions we answer, yes. "Then why do you say that action of separate bodies upon each other is impossible, when Aristotle and Kant and all the other great philosophers, in full view of this postulate, have not condemned the physical philosophy which has separate bodies acting upon each other? Have you discerned what these men failed to discern?" These questions are natural; but when we learn how those philosophers disposed of the difficulty, these questions lose much of their importance. The postulate—nothing can do where it is not—was known to the Greek philosophers; but when they looked out upon nature, they saw a world of facts which seemed to contradict it. Bewildered, dazed, they knew not what to say. Either the apparent facts or the postulate must give way. The facts, they said, are constantly before our eyes, separate bodies are drawn together, no one can deny

that. The apparent facts prevailed, and the postulate was laid quietly away, and the mystery was frankly admitted to be beyond human comprehension. Occasionally during the ages a philosopher would bring the postulate out of its retirement and object to the contrary popular opinion, but he had nothing but matter to present as the doer, and the apparent facts would still hold their supremacy. The philosopher said, it is not possible for separate bodies to act upon each other, yet they appear to do so—it is a mystery we cannot explain. They held on to the postulate, but made little use of it, because facts seemed to so positively contradict it.

Since the revival of philosophy in modern times the difficulty has been generally disposed of in about this manner: "It is true we cannot explain how remote bodies can act upon each other; neither can we explain how contiguous bodies can act upon each other—it is as great a mystery in one case as in the other." Of course, it is no explanation of one mystery to bring another mystery and place beside it. This is simply an admission that both are inexplicable mysteries, considering matter as the mover. If it be admitted that the molecules of all matter are separated bodies, the difficulty is as great whether we consider the bodies remote or near, for in both cases it is action between separated bodies, and the postulate—nothing can do where it is not—applies as well to bodies that are near and appear to touch as to those which are remote. In that case matter cannot be the actor or doer in any case, even within solid bodies, and we have matter as a doer thrown entirely out of nature and philosophy. But if we have the molecules of matter in actual contact, the two cases are not similar; in one case it is action between separated bodies, and in the other case it is action between bodies which touch, and we do not have matter acting where it is not.

But Kant, acknowledged to be the most profound and penetrating philosopher that has appeared among men since Aristotle, while he does as others have done, offsets one of these mysteries against the other, and declares them both impossible. We quote from Professor John Watson's "Kant and his English Critics," p. 250: "To the objection of attraction, as action at a distance, it is commonly objected that matter cannot act where it is not. How, it may be asked, can the earth immediately attract the moon, which is thousands of miles distant from it? To this Kant replies that matter cannot act where it is, on any hypothesis that we may adopt, since each part of it is necessarily outside of every other. Even if the earth and moon were in physical contact, their point of contact would lie in the limit between the two parts touching each other, and therefore each part, to act on the other must act where it is not." It will be noticed that Kant here admits that separate bodies cannot act on each other, and also declares that bodies which touch each other cannot act upon each other, because, though they may touch at one point or surface, all the rest of the substance making up the two bodies is separated, the matter of one body from the matter of the other body, by an interval of space. Thus he fully admits the validity of the postulate—no thing can do where it is not. Kant, so far from denying this postulate, positively asserts its validity, and declares that a thing cannot do where it is not.

The difficulty of matter acting at a distance is not removed by saying, neither can it act in contact,—it remains true that matter cannot act at a distance. I believe that matter cannot act anywhere, and what I am endeavoring to show here is that most natural phenomena are effected through intervals of space where the matter which is supposed to be the doer is not, and therefore that matter cannot be the doer.

Kant knew, and every other philosopher who admits that two contradictories cannot both be true, knows that bodies cannot act where they are not. But apparent facts seem to contradict this, and the apparent facts and this cannot be reconciled; so scientists disregard the contradictions, and go on talking about separate bodies acting upon each other, still calling matter the doer. The apparent facts which dispute this postulate are like the apparent facts which disputed the Copernican system of astronomy—the heavenly bodies seemed to revolve around the earth. The fact is, separate bodies cannot act upon each other—a thing cannot do where it is not. Then matter cannot be the actor or doer in any case of attraction, nor in any case of repulsion, except where one body in contact pushes another, and none of the so-called physical forces are matter, or material processes.

We are now prepared to answer the question, Is energy a property of matter? All natural phenomena in inorganic nature are produced through the processes of attraction and repulsion. We have found that in all cases of attraction, and in all cases of repulsion, except where one body moves against another and moves that, matter cannot possibly be the doer. We have found that five of the ten inorganic forces--gravity, electricity, magnetism, the chemical force, and the crystallizing force—do attract bodies through intervals of space, and that therefore they cannot be matter or material processes. If we discard the universal ether, which this writer thinks we have abundant reason for doing, we have light and heat moving through empty space, then they are not matter or material processes. We have found that electricity and magnetism do repel bodies through intervals of space; hence there are repulsions in nature which are not material processes, or molecular knocking. I think we have abundant reasons for discarding the dynamic as molecular knocking

theory of gases and vapors; then we have molecular repulsion and heat acting through intervals of space, then in these cases matter cannot be the doer.

We have now left only the two forces—cohesion and inertia—that are not shown to be not matter. These two forces never act beyond the limits of their bodies, so they cannot be shown by this test to be not matter. They do not offer any proof that they are matter, or that they are not not-matter; only the circumstances do not admit of their being shown to be not matter—they cannot be positively included among the not-matter forces.

When scientists thought they had shown that two of the inorganic forces were material processes, they did not hesitate to generalize that all of them are, and made but little effort to prove that the others were, and that without success, resting their generalization upon these two alone. We have shown five of them to be positively not matter, three of them to be probably not matter, and two of them not positively included, but giving no evidence to the contrary. Here, then, is ample foundation for the generalization that none of these are physical processes, and that matter is never the actor or doer in the physical phenomena of nature. In all the motions and doings in nature there is a manifestation of energy. If matter is not the doer, this energy is a property of something not matter. If matter is not the doer, this energy is not a property of matter. Even if energy were a property of matter, in the cases cited of action at a distance its energy could not be the effective energy, for a property cannot extend beyond the limits of its substance. Here, then, is ample basis for the generalization that energy is never a property of matter. There are few scientific generalizations so well established as this.

CHAPTER VI.

MOTION.

Motion is a fact that a portion of substance occupies different places in space in successive periods of time. It is not substance or property, but a relation. It is a space relation, a constantly varying space relation. It differs from location in the fact that the location of the substance is constantly changing. Location is a fixed space relation, at least in reference to other bodies. If a body occupies constantly the same space relation with reference to other bodies, we call it a fixed or located body. If it occupies constantly the same portions of space—if there are any such cases—it is really a fixed or located body. If it is constantly changing its place in space, or its relative distance and direction from other bodies, we say it is moving, and we call the fact of this change in its space relations motion. It involves also a time relation—successive periods of time. It is, then, both a space and time relation. Being only a relation, it is improper to speak of it as a doer. *Nothing but substance can do or be a doer.* Neither can motion be properly spoken of as a correlative of force or energy. These are not relations, and to speak of converting motion into force or energy, or force or energy into motion, is to speak of converting a relation into a substance or property, or a substance or property into a relation. If we speak of the equivalence between motion and force or energy, we talk nonsense. There can

be no equivalence between things so unlike, between a relation and a substance or property. How would this sound? above = extension, direction = matter, motion = substance.

Matter has no power to start itself in motion, or to move itself after it has been started in motion. In our previous examinations we have reached the following generalizations: Energy is never a property of matter, and nothing which does not possess the property of energy can move itself, or move anything else. We know from experience that all motion in matter is attended with an exertion of energy. If we start matter in motion, we do so by the exertion of energy. If moving matter comes against us we have to exert energy to resist it. By this we know that the motion of a detached flying body is attended with a constant exertion of energy, that its motion is continued by a constant exertion of energy, and by experiment we learn that the amount of energy exerted to continue the motion is just equal to that which started the motion. Thus we conclude that there is no motion in matter without the exertion of energy to move it, that the energizing continues as long as the motion continues, and that the motion would cease at once if the energizing should cease, that there is no continuance of motion after the energizing ceases.

PERPETUAL MOTION.

Motion, then, in order to be perpetual must be continued by a constant exertion of energy. There is no such thing as self-perpetuated motion. There is not in motion itself any tendency to perpetuity. Motion is the result of the energizing of something. To talk about a relation being self-perpetuating, and self-continuing, is to give to a relation causal power, and make it capable of doing, make it a doer. *Nothing but substance can be a doer.* If there is any decrease in the energizing, there is

a corresponding decrease in the motion, or in the velocity of motion. The energy of a moving body is not consequent upon its motion, but its motion is consequent upon the energizing of something to move it. The motion is the effect, and not the cause in this case. Motion—a relation—can never be a cause or doer.

Again, motion, to be perpetual must be without obstruction; that is, the energizing which is moving the body must not be counteracted by other energizing. As the motion of a moving detached body is continued by the continued exertion of energy, only something which energizes, something which possesses and exerts energy, can stop or retard the motion of the body. As nothing but a force, a substance possessing the property of energy, can move matter or cause motion, so nothing else can stop the motion of a flying body. All flying bodies moving in regions adjacent to other matter are acted upon, retarded, obstructed, by the forces in that other matter, and hence their motion is brought to an end. All visible motions, except those of the planetary worlds, continue for a little time, and then end. The planets are the only bodies known to us that move without obstruction; these meet with slight obstruction in the meteoric and ærolite bodies, but not enough to scarcely sensibly retard their motion. All known bodies moving in space adjacent to other bodies are obstructed and retarded. This, according to all rules of logic, is a legitimate basis for the generalization that all bodies moving in like circumstances, are obstructed and retarded.

But some are disposed to limit this generalization to visible or molar motion, and suppose that in the invisible or molecular realm of matter, motions may be perpetual. This supposition cannot be proven, and no attempt is made to prove it. It is merely an hypothesis by which

they would remove some difficulties out of the way of other hypotheses. All our knowledge of matter is of sensible bodies. In all our examination of nature we must proceed from the known to the unknown. What we find to be true of known matter we legitimately apply to unknown matter. When we find that a sensible mass of matter possesses the properties of impenetrability, inertia, and gravity, we conclude that any subdivision of that mass, however minute, must possess those properties. But scientists suppose that in one respect matter in the form of molecules differs from matter in the form of masses: masses are never perfectly elastic; molecules are supposed to be perfectly elastic.

We will consider this question in reference to the molecules of gases, and according to what is called the dynamic theory of gases. In this theory the molecules are supposed to fly about and knock against each other, and to be kept apart by this knocking.

Now, what ground have we for supposing that molecules are perfectly elastic? It is well known that sensible bodies of matter are never perfectly elastic. These are the facts which are to govern our opinions respecting unknown or insensible bodies of matter. These are the facts from which we generalize an induction in reference to all matter. In all known cases, in all instances discovered by man, bodies of matter are not perfectly elastic. From these facts we generalize the statement: Matter is never perfectly elastic; molecules are matter; therefore molecules are not perfectly elastic.

No reason is assigned why we should not include molecules in this generalization, except the usefulness of the supposition that they are perfectly elastic in the support of other suppositions. One supposition is made, and to accommodate that, another, and so on, till at last we have a system of physical philosophy resting entirely on a

series of suppositions; and in this case in direct contradiction to all known and discovered facts respecting matter.

This is not an hypothesis devised and then tested by an application to facts; but a supposition made to clear the way for other suppositions. Heat is supposed to be molecules in motion; all molecules are supposed to be in constant motion, moving forever of themselves; therefore we must not admit of any decrease in motion or kinetic energy, else we would not have an eternally self-moving universe; therefore we will suppose that molecules are perfectly elastic.

Though the mass is a gas, each molecule is a solid, so the question is of elasticity in solids. Let us consider the process of motion from elasticity in solids. When a marble ball is thrown against a solid block of marble it rebounds. This is explained by saying that the two bodies by collision are indented, the matter that has been thus indented springs back to its original form, and thus, like a spring, pushes the bodies apart. But the ball never leaves the block with the same velocity it had during its approach. This loss of motion is sometimes explained by saying that a quantity of heat is produced by the collision, and sometimes by saying that some of the matter composing the indentations is permanently displaced, and the indentations are not entirely restored.

We may give a more exact explanation of rebounding motion. The force of cohesion which holds the particles of matter together and keeps them in place, in its efforts to restore the indented portions to their former places, pushes the two bodies apart. The agent in this rebounding motion is cohesion. All rebounding motion from elasticity in solids is the result of the energizing of cohesion to keep the body in its original shape. Cohesion in solids is the agent which mainly stops the forward motion of a colliding body and sends it back; but inertia tends to

hold at rest matter which is now at rest, and perpetuate the motion of moving matter in a straight line. When the colliding ball strikes the surface of the block it meets with the resistance of cohesion and also of holding inertia in the block. It overcomes these resistances sufficiently to move a portion of the matter of the block so as to form an indentation in the block, and also so as to indent or flatten the ball, so that it is not perfectly round. A portion of the matter of the block is thus started in motion toward the center of the block. Cohesion soon stops the motion of that portion of the block and also of the ball in that direction, and starts them both back in the opposite direction. Cohesion thus starts back, as from a state of rest, the matter of both the ball and the indentation, a quantity of matter greater than the ball alone contains. The impact that started the ball in motion at first had to move only the matter in the ball; the agent which sends it back has to move more matter and can consequently move it at a less velocity.

If two balls moving in opposite directions collide, both balls are flattened. Cohesion in both balls pushes the flattened portions so as to restore the balls to their former globular form. This push drives the balls apart. Thus a portion of each ball, the portion forming the indentation, is started in motion in the opposite direction from that in which the ball itself is moving. This backward motion constitutes a jerk or pull backward upon the ball which must be overcome by the momentum of its forward motion, and which retards and lessens its forward motion, so the two balls do not move away from each other with the same velocity that they had in their approach.

These facts fully explain the loss of motion in all collisions in sensible bodies, where the bodies are not permanently changed in form, and they are just as applicable to bodies of insensible size, and they show the impossibility of what is called perfect elasticity.

Of course, if we say that molecules are centers of force, or points of divine energizing, we can apply to them no induction drawn from sensible bodies of matter, and we may suppose any thing we please respecting them; and the convenient dodge of the idealist is always available—he can always say with Professor Huxley: "After all, what do we know of matter, except as a name for the unknown and hypothetical cause of states of our own consciousness?"

But after we have supposed perfect elasticity in molecules there are still difficulties in the way of perpetual molecular motion in gases. All bodies moving near the earth are obstructed by the gravity of the earth. When the molecules of a mass of gas move away from the earth they are retarded; when they move toward the earth they are accelerated; thus the motion in the mass away from the earth must be less than toward it. When the molecules strike the earth they strike a body that we know is not perfectly elastic, and they do not rebound as far as they have fallen. On the lower surface of the mass of gas there is a layer of molecules that are beyond the reach of any molecules to knock them back, they are the outside molecules, and there are no molecules outside of them to knock them back, and they must fall to the earth. Other molecules are then the outside molecules, and there are no molecules outside of them to knock them back. Thus one layer of molecules after another must escape from the mass and fall to the earth, until they have all fallen. Thus admitting the perfect elasticity of molecules, perpetual motion of molecules in gases under this theory of gases, seems to be an impossibility.

But some believe in the perpetual motion of molecules who do not receive the dynamic theory of gases. Such believe that the molecules of a gas are held apart by a force, molecular repulsion, an invisible, undiscoverable something, which holds the molecules at a distance from each other. Each molecule in a mass

is pushed on every side from all its neighbors. It is known by experiment that this push increases in power as the molecules approach each other. Then there is a point at which each molecule will be pressed equally on every side, where the repulsion from all other molecules will be in equilibrium. There that molecule will rest, and any attempt to move it from that point will meet with the resistance of this push. If it be by some power external to the mass knocked from that position, it may vibrate back and forth for a little time; but every time it passes that point, it will be pushed upon one side more than on the other, and will soon be forced to a rest at that point.

It is understood that gravity acts between the molecules, and tends to draw them together. Some have seemed to suppose that the molecules might vibrate back and forth from the alternate prevalence of gravity acting between the molecules and the molecular repulsion. But there can be no such alternate prevalence. Both forces increase in the same proportion as the molecules approach, and decrease in the same proportion when the molecules recede. If, then, they are in equilibrium at any point, they are at all points of distance. But the attraction between molecules is so little that it has no power at all against the powerful repulsion. It is so little that Mr. Tyndall throws it entirely out of the calculation.

The attraction of the gravity of the earth tends to press the molecules of all gases together at the surface of the earth. This is as an outside power pressing the molecules together. This pressure is resisted by molecular repulsion acting between the molecules. The outside pressure is a steady and uniform pull, and when it presses the molecules together until the resistance of repulsion between the molecules becomes equal to it, there the molecules stop, and remain at rest. This is the case

first considered under this head; the outside pressure of the gravity of the earth upon the mass of gas was presumed in that case. I see no chance, then, for perpetual molecular motion, under this theory of gases.

The foregoing discussion applies to all gaseous substances, and also to all liquids and solids if their molecules are detached and separate from each other, as in gases, only separated by less distances. But we know that the molecules of liquids and solids are held together and all motion among them resisted by cohesion. The process of vibrations in liquids and solids, as it differs from that in gases, has not been agreed upon and definitely described. It does not seem proper to call these vibrations waves; they certainly cannot be inequalities in surface, like water waves, nor inequalities in density, like ærial waves. They have sometimes been represented by the communication of an impulse through a row of detached bodies. In such a case all the bodies in the row successively move forward, and hit those in front of them. Scratch the end of an iron shaft weighing ten tons with a pin, and the scratch may be heard at the other end, and at all points on its surface. We know that a very light tap with an iron instrument at one end, can be not only heard but felt, at the other end, and at every point on the surface of that end. Now, we cannot suppose that that scratch with a pin, or that light tap, was of sufficient power to move the whole of those ten tons of matter forward a little. This explanation of the process does not seem to be reasonable or possible.

These vibrations have sometimes been represented by the motion of a taut cord or wire. We know that the vibration of such a wire consist of deviations from a straight line. It may be a mere trembling, but that even is variation from a straight line. This seems to more fitly represent vibrations in a solid. But whatever be the

form of the motion, we know that cohesion resists motion of any kind in liquids and solids. The shortest distance between any two points is a straight line. When a taut wire is made to vibrate, every time it moves to the right or left of a straight line, it becomes more taut, and cohesion in it resists its further motion in that direction, and draws it back. This resistance of cohesion to any deviation from a straight line soon brings the motion to an end. It has been said that the motion of the wire is stopped by the resistance of the air. Admitting that the air is some obstruction, we learn by experiment that the motion of the wire will come to an end nearly as soon in a vacuum. But the motion of molecules in a solid body is resisted, not only by cohesion acting lengthwise as in a wire, but also by cohesion acting laterally. Every molecule in the body is held firmly in its place, bound to all contiguous molecules, by cohesion, and their motion thereby obstructed, whether the molecules touch each other or not. Then it is admitted that the vibrations of a taut wire are obstructed by the molecules of air around it. Suppose this wire to be surrounded by other wires, so that every time it moved one way or the other it would hit against another wire, would not its motion be obstructed much more than by the air? We may suppose vibrations in a solid body to be like vibrations in a bundle of wires, colliding with others at every move. This seems to be indicated by the fact that sound vibrations move more rapidly and further when they move lengthwise of the fibers of wood than when they move across them; and when the motion is parallel with the lamina of crystalline substances, than when transverse to them.

Now it is very easy to say that the molecules of all solids are in constant motion, and that they are a little way apart so as to admit of that motion; but whether they are in contact or not, we know that they are firmly

held in their places, and that their motion is resisted, by cohesion, and by collision with other matter. It is certain that in such circumstances perpetual motion is not possible. To satisfy the demands of a theory we cannot do such violence to all common sense, nor so contradict all the facts respecting matter known by observation and experiment.

We have still to consider the possibility of perpetual motion of waves in an ethereal medium. It is well known that all sensible waves soon come to an end. Friction and imperfect elasticity are alleged as reasons for this. But we know that these do not include all the reasons. Take as an example water waves. When a wave has been raised by wind, or any other means, above the common level of the surface, it is drawn down by gravity, and a portion of the water forming the wave flows down both inclined planes of the wave. If the wave is moving before the wind, some of the raised water flows down the back side of the wave, and reacts as an obstruction against the next oncoming wave. This is the main reason why water waves flow on for a little time, continually diminishing, and then cease to be, if the force which raised them ceases to act.

By the same process does gravity soon destroy all waves in an ærial medium. All such waves consist of alternate denser and rarer portions of the medium. Such are understood to be the waves of air which in our ears produce the sensation of sound. Why do these waves so soon end? What ends them? It is well known that gravity resists inequalities in density as much as inequalities in surface. This is given by all as the explanation of wind. The molecules of the atmosphere are pressed together on to the surface of the earth by the gravity of the earth. They are held apart by molecular repulsion acting between the molecules. The power of this expanding force in-

creases as they are pressed nearer together, as the square of the distance decreases. The pressure of gravity is a constant quantity. When the pressure and repulsion are equal, the molecules remain at rest; when they are driven nearer together—condensed—repulsion is stronger than the pressures and they are driven apart; when they become rarer than the equilibrium, the pressure exceeds the repulsion, and molecules from the surrounding denser portions are pressed into the rarer to restore the equilibrium. As the wave flows along, some of the molecules composing the denser portion are driven backward to fill up the rarer portion behind it,—some molecules on the border of that denser portion are pressed by repulsion on one side more than on the other, and are thus pushed back into the rarer portion. Thus the denser portion is constantly depleted, and the inequality between the denser and rarer portions is constantly diminished, until the two portions at last become equally dense, and the wave ceases to be. Thus all known waves in all ærial substances are known to be ended. In proportion to the strength of the two forces which press the molecules together and repel them apart, will be the rapidity of this destructive process. If the pressure of gravity upon the molecules of our atmosphere were a thousand times greater than it is, inequality in density in contiguous portions would continue only one-thousandth of the time that they now continue; but as the progress of the wave would be much more rapid than it is now, it would flow more than one-thousandth of the distance that it now flows. Now, in order that the supposed ether may be capable of transmitting the supposed waves of light and radiant heat at their known velocity, it has been decided that the pressure which pushes the atoms of the ether together, corresponding to the pressure of gravity which pushes the molecules of air together, must be a million million times as

great as the pressure of our atmosphere. How long would contiguous inequalities in density continue in a gaseous substance under such a tremendous pressure? Such impossibilities as this have driven scientists to say that this ether is a "jelly," a "solid," the "densest of all matter,"—that is to say, there is no material medium filling the interstellar spaces, and the undulatory theory of light is an impossibility.

According to the plan of this work, this is perhaps as much as it is proper for me to say here; but I will add that Sir Isaac Newton's famous argument against the undulatory theory of light has never yet been answered. He said that light cannot be waves of ether, for then an object would form no shadow. Waves of water and of sound flow around an intervening object, and leave no unoccupied space corresponding to a shadow, behind it. This argument stood as an insurmountable rock in the way of this theory, till the process of interference was thought of as an answer. The waves of light do flow around the body, they say, but they are cut off and quenched by the process of interference. Then the process of quenching rays of light with other light and producing darkness must be a very simple process. Every opaque body that the sun or moon or any other light has shone against has had its shadow, with clear cut edges; never once a failure, or partial failure. Surely it cannot be difficult to contrive some apparatus by which this simple process can be effected. Yet all the ingenuity of man has never been able to construct such an apparatus. No man has ever been able to make light quench light, and result in darkness. "Why! are not numerous instances given in our text-books?" No; they may have led you to so think; but you have been deceived. No such instance can be found in any text-book on earth. No man has ever yet been able to make one ray of light quench

another. As the reader may not have time or opportunity to search through all the books on light to see for himself that the foregoing assertions are true, I will quote the language of a very high authority corroborating them. In Deschanel's Natural Philosophy, translated by Professor J. D. Everett, and published by D. Appleton & Company, on page 1049, we find the following words: "Beams of light from different sources, even from different points of the same flame, or from different parts of the sun's disc, cannot, by any treatment whatever, be made to exhibit the phenomena of mutual interference." He gives a reason why, but that reason applies as well to light in the case of shadows. All kinds of light, from all sources, in all circumstances, if the rays are intercepted by an opaque body, produce a shadow—they say because the rays behind the intervening body are cut off by interference; that is, the rays which flow around the body on different sides of it meet and cross each other, and in the language of common life, put out each other, and result in darkness; and yet man has never been able, "by any treatment whatever," to cause one beam of light to cut off or darken another beam or ray. Until men can show by some experimental process that the phenomena of interference is possible, it is vain to say that it occurs constantly in every case of a shadow.

Well, if the teachings of this chapter are true, they are very iconoclastic. We have shown that perpetual motion in gases, liquids, and solids is impossible; then the dynamic theory of heat is impossible. We have shown that perpetual waves in a supposed ether are an impossibility; then the undulatory theory of light is impossible.

CHAPTER VII.

INERTIA.

The first law of inertia is: *Matter has no power to start itself in motion.* This is another way of saying that an exertion of energy is necessary to start matter in motion. This follows from the fact that energy is not a property of matter; and it is also another proof that energy is not a property of matter. Energy is that property of things by which they cause motion. If matter possessed this property, it could start itself in motion.

We state as a second law of inertia: *Matter cannot move itself after it has been started in motion.* Energizing is as necessary to continue motion as to start it. We know that the motion of flying bodies is continued by the exertion of energy, by the fact that an exertion of energy is necessary to stop them. Newton's third law of motion—Action and reaction are equal and in opposite directions—is admitted by all scientists. If this be true the reaction which stops a body is only equal to the action in the body; there must be something there which acts. It is not the force which gave the starting impulse, for that has ceased to act upon the body. It is not the matter of the body, for energy is not a property of matter. *No energizing without an energizer.* Then there must be something else there which is the energizer, which does possesss the property of energy. We have found that in four-fifths of all natural phenomena, the forces which produce them

extend and work beyond the limits of the material bodies, and know thereby that they are not matter. In the case of flying bodies there is something which energizes to cause motion which does not extend and do beyond the limits of the bodies. In all those other cases we know that the energizer is not matter; hence we conclude that in this case the energizer is not matter.

We present as the third law of inertia: *When matter has been started in motion something tends to move it perpetually.* We see bodies every day moving beyond the reach of the impulse which started them. In all such cases motion continues for a time, and then stops. We can see why it stops. In the case of detached bodies flying through the air, the motion is stopped by the obstruction of the air and by gravity. As we can discover the stopping agencies, we conclude that if they were absent, the motion would be perpetual. Then in the case of the planets, we have bodies moving without obstruction, and their motion is perpetual.

Hence we present as the fourth law of inertia: *Motion to be perpetual must be without obstruction.* The condition of perpetual motion is the absence of obstruction. The obstruction can be nothing but a force. Energizing is necessary to stop moving matter; hence nothing can be a stopper, or an obstruction, that does not possess the property of energy. The obstruction may be an attractive force acting through space behind the moving body, or a repellant force acting through space in front of it, or a force which energizes to hold matter at rest. A body stopped by collision with other matter is stopped by the force or forces which are holding that matter together and in its present place in space. The only perpetually moving bodies yet discovered by man are the planetary bodies, and these are the only moving bodies known to man that move without obstruction. By bodies here we mean

atoms and molecules, as well as masses. See preceding chapter.

We present as the fifth law of inertia: *Moving matter, if not acted upon by anything outside of itself, always moves in straight lines.* The force which moves detached bodies always energizes to move them in straight lines. Practically the motion of flying bodies is never in straight lines; but we know what agents turn them from right lines, and we can see that if these agents did not operate upon them, their motion would be rectilinear. All inorganic bodies moved only by a force within themselves move in right lines, and no other. The force which moves detached bodies persists in right-line motion; it will not move bodies in any other way. If the body strikes against another body and glances, or if it is knocked by another body out of its course, it immediately resumed straight-line motion in another direction. Discovering thus the mode of this force, we know that if any body, mass or molecule, moves according to any other mode, it is not moved by the force which perpetuates the motion of flying bodies,—we know that some other force outside of the body is acting upon it, and turning it out of a straight line. All circular and zig zag motion must be the result of two or more forces. No one can argue from the fact that straight line motion is perpetual, that any other mode of motion is. The facts and phenomena which occur under this law of motion can never be adduced to prove that any other mode of motion is persistent. All motion of bodies without an external mover known to man is in straight lines, except as some other force outside of the body turns it from a straight line.

This force resists any other mode of motion. An exertion of energy is necessary to turn a flying body out of its course. It is strange that any man should write, "No power, no energy is required to deflect a bullet from

its path, provided the deflecting force acts always at right angles to that path," (Unseen Universe, p. 180). When it was said that no work was done by turning a flying body out of its course, we could understand that the word work could be so defined as to make the assertion true; but when it is said that no "power or energy" is required, it is a great mystery. The degree of energy with which this force persists in trying to keep its motion in a straight line may be seen in the bursting of millstones, grindstones, wheels, and threshing machine cylinders, when revolving with great velocity. It requires as much energy to turn a flying body out of its course forty-five degrees as was required to start it in motion at its present velocity. The pull of this force in the earth in its efforts to make the motion of the earth a straight line is sufficient to draw the sun out of its place in space, and move it around in an orbit. Thus some astronomers also suppose the worlds have been thrown off from the surface of the skrinking sun.

If circular motion is produced by collision, the collision must be continuous. One collision would only turn the two bodies out of their course in straight lines in different directions. If the two bodies adhered together, the mass made up of the two would continue to revolve on its axis, if unobstructed, forever; but if they parted, they would fly off from each other in straight lines. It matters not by what force a flying body is turned out of its course, nor how many times it is turned, as soon as the force which turned it ceases to act upon it, it resumes its normal straight line motion.

As it requires an exertion of energy to turn a flying body out of a straight line, as it costs a flying body the loss of dynamic energy to turn another flying body out of a straight line, the loss of dynamic energy in circular motion produced by collision must be continuous. Sup-

pose that two currents of molecules, moving in opposite directions, meet each other. We will designate one current by the letter A, and the other by the letter B. The molecules of A collide against the molecules of B, and whirl them around in a revolving motion. The molecules of B do the same to the molecules of A, and we have a vortex or whirl of molecules. The molecules of both currents lost some of their dynamic energy by their work of turning the molecules of the other out of their course. After all these molecules have been deflected by the first collision, they would of themselves resume their straight line motion in a multitude of tangents from the periphery of the whirl in all directions. The circular mode of motion is constantly resisted by a force which dwells constantly in matter. The collision and turning of A by B, and of B by A must be constant to produce vortex motion, and the waste of dynamic energy must be continuous without any possibility of replenishing it, and the two currents must soon destroy each other. The struggle for straight line motion is a continuous exertion, and must be forever counteracted by a continuous contrary exertion, and the waste of dynamic energy must be continuous, until it is all used up. There is no waste in the energy that persists in right-line motion; there is waste in the dynamic energy which turns the body; the wasteless must survive the wasting and exist alone. Perpetual vortex or circular motion from dynamic energy is an utter impossibility.

We present the following as the sixth law of inertia: *This force has two modes of action, holding and moving.* Matter at rest remains at rest not merely because something is not moving it, but because something is holding it at rest and resisting efforts to move it. There is as much energy exerted in the matter to hold it at rest as there is exerted afterward to move it. The amount of

energy required to start it in motion is just equal to the dynamic energy it will possess after it is started. The matter is at rest, but the energy is constantly exerted. On the condition of rest, the force exerts its energy to maintain that rest. On the condition of motion, it exerts its energy to perpetuate that motion. On the condition of motion in one direction, it exerts its energy to continue that direction, and to resist motion in any other direction. Its energy is always exerted to keep matter in its present state of rest, motion, and direction. It is a constant resistance to change.

When a body is started in motion in one direction, only its holding energy which corresponds with that direction is affected by the change. If an attempt be now made to move it at right angles with the line of its present motion, it resists our effort just as much as it would if it was at rest. If an exertion of energy is necessary to start a body in motion, precisely the same amount of energy is required to turn it forty-five degrees from its present line of motion.

We present the following as the seventh law of inertia: *This force increases or decreases its energizing in proportion as the square of the velocity of its body increases or decreases.* If a body is at rest, and we undertake to move it slowly, its resistance to our effort is little. If we undertake to move it at great velocity, its resistance to our effort is great. Its resistance to our effort does not increase merely as the velocity at which we attempt to move it increases, but as the square of that velocity increases. If we start a body in motion at the rate of one foot in a second, its resistance is *a*; if we undertake to move it at the rate of ten feet in a second, its resistance is not merely ten *a*, but the square of ten, one hundred *a*. If a body is now in motion at the rate of one foot in a second, it requires *a* energy to stop it. If it is moving at

the rate of ten feet in a second, a quantity of energy equal to one hundred *a* will be required to stop it.

Thus we see that matter is held at rest and moved by a force which has a peculiar mode of action, a force which has a peculiar mode in relation to velocity. We see that the force which holds and the force which moves has the same peculiar mode with reference to velocity; hence we conclude that it is the same force.

We find, then, that in this class of phenomena there is in bodies something which energizes, something which possesses the property of energy. We have found that in almost all other natural phenomena the something which energizes can not be matter; hence we conclude that this something is not matter. We see also that this something has peculiar properties and modes, (1) energy, which we do not find in matter anywhere else; (2) modes of action that we do not find in any other force; it resists motion, and continues motion, it resists motion after a peculiar manner with reference to velocity, and it continues motion after the same peculiar manner. These are fixed modes and permanent properties of something. No property without a substance. There is some substance there which possesses these properties, and which is the doer. That substance is not matter. That substance is what we call the force of inertia.

When one body moves against another and starts that in motion, what takes place? Is energy imparted to the moved body? A property imparted, transferred from one body to another! Is motion imparted? A relation imparted, transferred! We will have to use language more carefully than this, or we deceive ourselves. The explanation is this: the static mode of inertia is changed to the moving mode—static inertia is changed to moving inertia. There is no more energy in the body, but the energy that was employed holding, is now em-

ployed moving. The energy which resisted the motion was just as much as that which is now moving it. The dynamic energy of a flying body is the energizing of the force of inertia. Here is a true case of conversion, not of one force into another, not of one form of energy into another, but of one mode into another mode of the same force. This is the only conversion in nature. Discovering cases of this, and not understanding them, men have been led into all this talk about the conversion of one force into another, of one form of energy into another. This is all there is of it. Out of the modes of this force also grew the dynamic theory of matter; and this is all there is of it. When men have talked about one moving body imparting motion to another, the moving body did not impart anything to the moved body; the energy that was energizing to move the body used its body with which to push or move the other body. When they have talked of one body imparting energy to another body, the energizing in one body has changed static inertia into moving inertia in the other body,—changed holding energy into moving energy. The hitting body lost nothing; just as much energy is now employed holding it, as was before employed moving it. The hit body has gained nothing; just as much energy was before employed holding it, as is now employed moving it. This is all there is of the dynamic theory of matter. It was a great undertaking to show that all natural phenomena—even gravity, and all the other forces—were only the doings of the force of inertia. It is not the first time that men have found a limited and local principle, and have endeavered to inflate it into a universe.

CHAPTER VIII.

ENERGY.

Without reviewing the opinions and theories of others respecting energy, I will endeavor to present what appears to me to be its true exposition. First we must endeavor to obtain a clear conception of what energy is. Is it substance, or an attribute or property, or a relation? Does it occupy space? Does each portion of energy occupy a certain portion of space? Has each mass of energy extension, form, and dimensions? Is it capable of independent existence in space, without being attached to, or held in being by something else? Can we conceive of a portion of energy existing in space, occupying a certain portion of space, existing independently and alone, having extension, form and size? If this be a description of energy it is substance. Substance, and only substance is capable of self-existence in space. Only substance of itself occupies space. Only that which of itself occupies space can be moved, or made to occupy successively different places in space—that which does not occupy one place cannot be made to occupy two places successively. All that is, except substance, exists in space only because of the existence of substance there, kept in dependent being by the presence of substance. Nothing else can exist in space disconnected from substance. If energy is substance it may exist in space detached from all other substance; if it is not substance it cannot thus

exist. If it is substance, it may be moved through space; if it is not substance it cannot be thus moved, nor thus move itself—it is utterly incapable of motion. If it is substance it may be transferred, communicated, translated from one body to another; if it is not substance it cannot be thus translated; incapable of independent being in space, as soon as it is detached from one body it goes out of being and in the space between the two bodies it has no being, and that is the end of it.

Now, what do we know of energy in objective nature entirely outside of our experience? Can we see it or feel it—can we discover it through any of our senses? We can discover through our senses matter and motion, nothing more. Energy is not matter, and motion is not energy. We have already mentioned two ways by which we can discover substance: (1.) where we discover a property we know there is substance; (2) where we discover doing we know there is a doer, and all doers are substance. Neither of these means lead us to the discovery of energy. The existence of energy in objective nature is an inference based upon our subjective conscious experience. We energize; that is all we know about energy; all else that we may think, or believe, or say about energy is made up of inferences from this fact. Then, as all our knowledge of energy is our subjective experience of energy, and as all the philosophy of energy is made up of inferences from this experience, we must go to our consciousness to learn what energy is, and all our philosophy of energy must be determined by what we discover respecting energy in our subjective experience of energy. We come then to the question: what is energy? We answer, primarily it is an ultimate fact of consciousness, of which no definition can be given, except to point to that in our conscious experience to which this word has been applied as a name. When we move our

bodies and through them other things, we are said to energize, or to exert energy. When other bodies pull or push us we energize to resist them, and prevent motion and maintain our place in space. That which we are conscious of using at such times, for these purposes, and in this work, is called energy. It is a power inherent in us, a property of ourselves. These are the facts as given in consciousness. We start our bodies in motion by the exertion of energy. We start other bodies in motion by the exertion of energy. We resist efforts to move our bodies, and we keep them in the same place in space with reference to other bodies, by the exertion of energy. We hold other bodies from being moved by the exertion of energy. The man who has great power to move things is said to possess a great amount of energy. To that which we use in all these activities, the common usage of mankind has applied the word energy as a name. There is nothing in the discoveries of modern science which demands any change in this usage. Unproved hypotheses and unestablished theories cannot revolutionize language. Webster's definition of energy is as good for science and philosophy as for common life and literature. He defines it as "Internal or inherent power; the power of operating whether exerted or not." Knowing that that which we use in our activities is a property of ourselves, we may define energy as that property of some substances by which they are enabled to cause motion, and continue motion, and prevent motion, and maintain rest.

Objective energy is not directly discoverable by us. According to a necessary mode of our minds, when we see motions and changes we believe that the cause of those changes is. But we know the process of causation only by our experience. We might see bodies moving, we might see one body move against another and see that begin to move, but we would not and could not

know that there is any energy involved in the phenomenon, except by reference to the knowledge of energy obtained in our conscious experience. We know from our experience that there must be an exertion of energy to move matter. We know by our energizing to resist it, that when a moving body comes against us, it energizes upon us. When, therefore, a moving body strikes against another body, and that begins to move, we understand that it does to that body what moving bodies do to us, exerts energy upon it. Thus from our experience we are able to understand the fact of energizing in phenomena which are entirely objective to us. We have no knowledge whatever of any energy in nature, except as that knowledge is based upon our experience of energy. We discover objective energy only by the fact that the circumstances and results are the same as when we energize and effect results. The connection between subjective and objective energy is the subjective principles: Like doings are the effect of like doers. Knowing the circumstances and results when we energize, and seeing the same circumstances and results in objective nature, we say there is energizing there. Thus all our knowledge of objective energy is merely the transference of facts known in subjective experience to objective things. Then the energy which we conclude to be in external things is not and cannot be anything different from that known in experience. We cannot transfer from our experience, and locate in external things, something unlike what is in our experience—we cannot transfer from us what is not in us. Then it is such energy as we find in our experience that we suppose to be in external things. When we speak of energy in external nature, we mean just the same that we mean when we speak of energy in ourselves. Objective energy is just like subjective energy.

We know in our consciousness that the energy we exert

to move our bodies and to move other things is something which is inherent in us. It is not something communicated to us, and through us operating on other things. We have power in ourselves without receiving any impact from objects outside of us, to move our bodies, to start them from a state of rest to activity. It is a power inherent in our bodies. It is an inherent attribute, characteristic, property of ourselves. Subjective energy, then, is a property. That point is settled, subjective energy is a property. Then, as all our knowledge of objective energy is but a transference of this subjective knowledge to external things, all objective energy is a property, and if a property it must be a property of some substance. Notwithstanding the involved inconsistency, the latest definitions of energy given by scientists, notwithstanding their designedly restricted form, make energy to be a property—"power to overcome resistance," "power of work." Power is not something which may exist in space apart from substance. Power is an attribute or property of something. Something has this power. It must abide in, be possessed by, something. Energy is always a property of some substance, and there is no energy that is not a property.

No property can exist without its substance. Then wherever energy is manifested, wherever there is energizing, there must be a substance of which the energy is a property. No motion without energizing; no energizing without an energizer; no energizer that is not substance; no substance can be an energizer that does not possess the property of energy. No matter ever did move, or ever will move, without the exertion of energy upon it or in it. It is not enough that something did energize to start the motion. No matter ever continues in motion after the energizer that moves it ceases to energize. The energy

must abide in some substance, and that abiding energy is the property of that substance which enables it to move matter.

If energy is a property, it can have no existence apart from its substance. Then it is not something which has "real objective existence." If it is a property, it can never be communicated from one body to another. A property separated from its substance ceases to be. During its transit from one body to the other it is connected with neither, and if it exist at all, it must exist in space attached to nothing. In view of this how does the theory of a stream of energy running on through the changing phenomena of matter, passing from one body to another appear? A stream of elasticity running on through the world, passing from one body to another, dividing up into a thousand little streams of elasticity, leaping here and there, and running on forever!

There are not several kinds of energy; there is only one kind, only that kind which is known to us in consciousness as a property of ourselves. What is the meaning then, of kinetic, dynamic and potential energy? Kinetic or dynamic energy is defined as the power a moving body has to move other bodies. What is it really? Let us see. Here is a body moving toward the earth. It is said to possess dynamic energy. What makes it fall? What is the mover? We answer, gravity in the earth and in the body. Gravity is pulling the body toward the earth. If gravity did not pull, the body would not move. If at any time during its falling, gravity should cease to pull upon it it would move on at the velocity it has already acquired, moved by the force of inertia in it. It is the pulling of gravity that accelerates its velocity as it approaches the earth. The movers are gravity and inertia. The dynamic energy possessed by it in consequence of its motion is attributable to them. It is their energiz-

ing which causes and continues its motion. It is their energizing that we would encounter if we should try to stop it. What, then, is the dynamic energy of a falling body? It is the energizing of gravity and inertia. Some physicists may smile as I speak of the energizing of inertia. Some others smile when they speak of inertia as a mere passivity.

Again, there are some molecules of air driven before the lightning. They strike against other molecules, and their dynamic energy is such that they produce a flame of heat and light. What is the dynamic energy of these moving air molecules? It is the energizing of electricity. Atoms and molecules are drawn together by the chemical force with so much power that they make sensible a large quantity of heat. What is their dynamic energy? It is the energizing of the chemical force. Molecular repulsion moves molecules apart, and thus moves masses. What is their dynamic energy? It is the energizing of the force of molecular repulsion. Heat moves molecules apart, and thus moves masses. What is their dynamic energy? It is the energizing of heat. If a man pushes a billiard rod, what is its dynamic energy? It is the energizing of the muscular force in the man. If he runs, what is the dynamic energy of his body? It is the energizing of the muscular force and the force of inertia in his body. If he strikes downward with a sledge, what is the dynamic energy of the sledge? It is the energizing of the muscular force in the man, and of the force of gravity in the earth and sledge, and of the force of inertia in the sledge. What is the dynamic energy of a train of cars, or of a steamboat, or a steam mill? It is the energizing of heat and inertia. What is the dynamic energy of wind, and of falling water, and of an ascending balloon? It is the energizing of gravity. What is the dynamic

energy of detached flying bodies? It is the energizing of the force of inertia.

I care not what question you ask of any case of dynamic or kinetic energy found on earth, in every case I can answer that it is the energizing of one or more of the already known and named forces. In all cases of moving matter the force of inertia in it continues the motion in straight lines after the force that started the motion has ceased to energize upon it, until the motion is stopped by some obstruction.

The answeis to all the foregoing questions contain one common word—energizing. However, many more similar questions may be asked, if they cover all possible cases of dynamic energy, all the answers, if true, would contain that word. In general, then, what is dynamic energy? It is energizing. All dynamic energy is the energizing of some force. What is called dynamic energy is not energy at all, but energizing. It is a name given to a certain class of energizings. All moving bodies are moved by the energizings of some force, and the powers of the moved body—as it is said—to move other bodies is not the body, but the force which is moving the body. Here, then, is no new or different kind of energy from that which we subjectively know. Nor are the facts in this case any different from the facts in our experience of energy. Some substance here, possessing the property of energy, energizes to move matter; and if that matter moves other bodies, it is the force which is moving it that moves them, through the medium of that matter; just as a man can take a stick and move by it another body.

Dynamic energy is not substance. Then it has no permanent independent existence. It is not a property. It is not a permanent inherent characteristic of substance. A body may possess it—as the expression is—one minute, and the next minute not possess it. It ceases to be as

soon as the force which is moving the body ceases to energize upon it, or as soon as the circumstances render it impossible that the energizing should produce motion. Dynamic energy is a relation. Energy is a property, but energizing is a relation. It is a relation existing between the energizer and the work done. Energizer; energizing; work done. Force; energizing; work done. Force; dynamic energy; work done. The last two sentences are identical statements, because dynamic energy is the energizing of something. What do you think of the propriety of talking about a relation doing? We might as well talk about distance, or direction, or above, or below, or any other relation, doing, as to talk about dynamic energy doing. The doer lies back of the dynamic energy. The work accomplished is the work of the doer, and not of the doing. It is strange that men will say that gravity in the earth draws a falling body down to it, and then say that the dynamic energy of the falling body is the doer of the work done when that body reaches the earth. If the fisherman should say, The spear killed the fish, or the billiard player should say, the rod moved the ball, you would call it a vulgar misuse of language. When a a boy throws a stone and kills a bird, you do not say, the dynamic energy of the stone killed the bird. The immediate agent in this case is the force of inertia in the stone, but the boy started that into active energizing; hence everybody says, the boy killed the bird with the stone. In all cases of moving bodies, the bodies are only the instruments which some of the forces are using with which to do work. In the common language of everyday life, it may be excusable if people sometimes speak of the instrument as the agent, but in science, when professing to give the exact explanation of phenomena, to do so, and to carry out that mode of speech in a well considered and voluminously elaborated system, by which all

natural phenomena are to be explained, what must we think of it? The whole system of philosophy which represents dynamic or kinetic energy as the doer is reducible to, the spear killed the fish, the stone killed the bird.

What is potential energy? Well, it is not much of anything; it is an empty name. Scientists mean by it the kinetic energy which may at some future time be. Let us examine the meaning of that sentence. May at some future time be—then it is not anything that now is. Speaking of a future possibility as a thing now existing, and quantifying this non-existence, and placing it in an equation with existence, seems to be very loose philosophy, to say the least. But when we consider that that something which may be, when it comes to be will be no *thing* at all, but only a relation, the energizing of some force in circumstances which admit of its producing motion, the promise of that future existence becomes a very small matter—the promise of an agent, which when it comes to be is not an agent. Gravity pulls upon a body when it lies motionless upon the brink of a precipice; it pulls no more upon it while it is falling; it pulls just as much upon it after it has fallen. The only difference in these cases is that in one of them the circumstances are such that its pulling produces motion. These circumstances are only a condition of the motion; gravity is the energizer, the doer. In the first case, the body on the brink of the precipice is the condition in the presence of which gravity may do; in the second case, the condition is such that gravity is doing; in the third case, the condition is such that gravity cannot do—it energizes the same, but its energizing cannot cause motion. If the work which in the first case gravity can do, and the work which in the second case gravity does, are correctly quantified, of course they are the same, for it is the same work which is quantified. After part of the work which it could do is done,

there is so much less to be done. As the body descends, the work done continually increases, and, of course, the work to be done continually decreases. Is it not strange that any man should have called this a conversion of potential into dynamic energy?

"Energy of position" is only another name for that non-existence which we have described under the name of potential energy—the body is in a position which allows some force to move it.

And now, what about the "conservation of energy?" I once said to a very distinguished college president, There is no truth in the modern doctrine of the conservation of energy. He replied, "You must be mistaken; you know that it has always been held that the quantity of energy is unchangeable, however varied the machinery through which it works." Thus the old and well established doctrine that a certain amount of energy will accomplish a certain amount of work, and that that amount of work cannot be increased by any mechanical contrivances is supposed to be identical with the modern doctrine of the conservation of energy. Suppose you push upon a lever, that push cannot be made to do more work—estimating work by multiplying the weight of the body moved by the distance moved through—by any mechanical appliance. That push extends through all the wheels, pulleys and bands, unchanged in quantity, except as it may be decreased by friction. That is one fact. But suppose you stop pushing, will that push continue to run on in the machinery, after you have stopped pushing, on and on forever? That is another question. The two questions are not at all identical. This latter question answered affimatively is the modern doctrine of the conservation of energy. One doctrine is that a push cannot be varied in quantity while the pushing continues. The other doctrine is that a push once started will never stop.

Suppose you try it and see if the push you make with that lever will continue to run on forever.

When the doctrine of the conservation and correlation of forces, as it was then called, was first published in this country, I received it enthusiastically. As I read the proofs of the doctrine, and saw that Mr. Grove and others mixed up motion, energy, and force, and counted motion in the equation, giving it a dynamic value, I was set back somewhat; but I was so earnest in the reception of the doctrine that I passed over that. Then when I saw that the energizing of a man in lifting a body from the earth was stated as the antecedent of the energy manifested during its falling; and the energizing of a man in mixing together an acid and an alkali was presented as the antecedent of the energy manifested in the chemical action which followed, I again paused and demurred. But, notwithstanding these slips in its advocacy, I thought the doctrine must be true, it is so nice, so rational in appearance, and so beautiful. So I passed over these and other like absurdities, and came out as I started, a firm believer in the doctrine. When I came to review the arguments, and sift out all such absurdities, I found that the doctrine had rather a slender foundation, and I began to doubt. Then I thought, this is a new doctrine, these men are exploring a new cavern, it is to be expected that they will make some mistakes; it seems that the doctrine ought to be true, and by continued investigation it may yet be adjusted to the facts.

I saw that the theory required that when a force accomplishes any results, it should to the same extent itself decrease; but the facts seemed to be that the forces do energize constantly through ages, centuries, and aeons, without any waste or decrease in their own power. If gravity weakened by its energizing to turn the worlds into orbits, they would begin to move off farther from the sun.

If inertia weakened by its hurling, the worlds would begin to approach the sun. If the chemical force weakens by its energizing, chemical compounds would begin to fall in pieces, and if it varied in strength, no calculations could be made respecting chemical reactions. Of course, scientists saw this, and so modified the doctrine as to make it demand a decrease in the agent only when work is done, change effected. But it appeared to me that turning flying bodies out of their course is work, change, and we know that it costs another flying body the loss of energy to effect this change—see page 92. Hurling worlds through space must certainly be work. Gravity draws bodies to the earth, yet there is no decrease in the agent. The chemical force draws atoms and molecules together, yet it suffers no decrease. The crystalizing force works in the construction of crystals, but loses nothing of its own power. Electricity works on and on, producing, as it is said, heat and magnetism, but suffers no decrease in strength. Magnetism works, producing heat and electricity, and mechanical work, yet growing stronger itself. Heat is the only force that ever seems to suffer loss by work, and all cases where this appears can be as well explained, better I think, by the old method of supposing that the disappearing heat goes into a state of latency.

Then the theory requires that the forces be convertible, or transmutable, one into another; but facts do not in this accord with the requirements of the theory. Gravity is said to produce heat, but there is no decrease in gravity. Inertia in flying bodies is said to produce heat, but there is no decrease in inertia. The chemical force is said to produce nearly all our artificial heat, but there is no decrease in the chemical force. Electricity is said to produce heat and magnetism, but there is no corresponding decrease in electricity. Magnetism is said to produce heat and electricity, but there is no decrease in the magnetism. Electric-

ity appears to produce by induction other electricity, but there is no decrease in the producing electricity. Magnetism appears to produce by induction other magnetism, but there is no decrease in the producing magnetism. A case of the conversion of one force into another has never yet been discovered by man. In all these cases of what is called production, it is evident that there is no real production. It is probable that what is called production of heat is only bringing heat out of a state of latency into a sensible state, and that what is called the producion of electricity and magnetism is a separation of the two kinds of each which exist in a state of quiescent union in all matter.

It is admitted by all that practically, experimentally, there is never any equivalence between the different forms of energy. A certain amount of heat is said to produce a certain amount of mechanical energy, but in no case can that mechanical energy be made to produce as much heat as was employed to produce it. Heat is said to produce mechanical energy in the armature of the electromotor, and this mechanical energy is said to be converted into electrical energy, which is carried away through the conductors. Now, the heat energy is more than the mechanical energy, and the mechanical energy is more than the electrical energy. The electricity can never be made to produce as much mechanical energy as was required to produce it, and the mechanical energy can never be made to produce as much heat as was required to produce it. In every series of successive forms of energy, every subsequent form is less than its predecessor, unless some other form of energy comes in to make up the loss. Thus all experimental tests pronounce their verdict against the doctrine of constant equivalence. This is admitted by all, and various reasons assigned for it—the dissipation of heat into surrounding bodies, the loss of energy in overcoming friction, the production of heat energy through

friction, the dissipation of electricity into the surrounding air, and of heat into remote space, etc.

Fully admitting all these facts, and to avoid the admission of decrease, Thompson and Tait have called this a degradation of energy, instead of a decrease of energy. They talk about grades of energy, and when energy drops from a higher into a lower grade of energy, it is less effective for work. Now, all energy is measured by the amount of work it is capable of doing, and when it becomes less capable of doing work, we say there is less energy, and we do not evade the fact by calling it by another name, by calling it a degradation of energy. If we represent the successive forms of energy by the letters of the alphabet, and estimate the amount of energy by the amount of work it is capable of doing, it is never true that A=B=C, and so on, but each successive form is a diminished quantity. It is never possible to reverse the process and work back through C, B, A, and reach the same quantity of A with which we started. Hence the conclusion to which scientists have reached, that the quantity of energy upon the earth has been continually diminishing ever since it was a world of fire, and that it will continue to diminish in quantity, until the earth, a cold, dead world, will at last revolve around a cold, dead sun, unless the members of the solar system shall before this have fallen together. This I found to be the present stage of the doctrine of the conservation of energy, which is not a conservation at all, nor a constant equivalence, but a constant decrease, and ultimate annihilation of energy.

Now, as some of the forces continually energize, effecting changes in physical things, without suffering any loss themselves, and as one of the forces is never transformed into another, and as in all cases of successional forms of energy each succeeding form is demonstrably shown by experiment to be less than its predecessor, what is there

still remaining of the theory of the conservation of energy?

When I took a still broader view, and observed the relation of this doctrine to other doctrines, and to the whole field of physics, my doubts were confirmed. The theory requires that the molecules of all solids be detached bodies and in constant motion, and that I could not believe. It required that all the inorganic forces be molecular motions, or moving molecules. When I first learned of this, I thought, may be that is so; I will see. Then the question arose. How can moving molecules draw other moving molecules from which they are separated by intervals of space? No one could answer this question; so all the attractive forces, gravity, electricity, magnetism, chemical attraction, and crystallizing, attraction remained unexplained. I will wait and see; perhaps some way of explaining them may be discovered. But no; years and decades passed, and no explanation appeared. Neither was it explained how one mass of moving molecules could repel another mass of moving molecules from which they were separated by intervals of space. Nor was it possible to explain how one mass of molecules acts upon a remote mass of molecules in the phenomena of electrical and magnetic induction. Thus the theory that the forces are moving molecules was found capable of explaining only a very few of the natural phenomena involved in it. On further reflection it was seen that the action of one mass of moving molecules upon another mass of moving molecules separated from it by an interval of space, was, not only unexplained, but inexplicable, impossible, absurd. Then he who would receive this theory of the forces must do so without evidence in its support in face of its known incompetence to explain phenomena, and in face of a positive contradiction, involving in itself a contradiction —having a thing doing where it is not.

Then it became necessary to exclude the inorganic

forces from the problem. The original proposition was: All molar motion (kinetic energy), plus all molecular motion (the forces), plus all potential energy, are a constant quantity. Throwing out the forces as molecular motions, the proposition is, All molar motion that is, plus all molar motion that may be,—or in other words, All dynamic energy that is plus all dynamic energy that may be, are a constant quantity. Then, when we consider that molar or kinetic energy, the energy of moving bodies of sensible size, is not the energy of those bodies, is not energy at all, but the energizing of some one or more of the forces moving those bodies, we see that our proposition has vanished into nothing, and we have no thesis to maintain. What will the proposition then be? The question will not then be, Do the forces always energize to the same extent, for we know that some of them—as gravity and inertia—do always energize with precisely the same power upon all matter, admitting the variation of gravity from distance, and of inertia from velocity, while some of the forces—as the chemical and crystalizing forces—often do not energize upon bodies, because they are beyond their reach; but the question is, Is there always the same number of bodies, or the same amount of matter, so situated that the energizing of the forces can move it? Thus our original proposition has vanished out of our hands, and the question is not now anything respecting energy, but only a question of the position of bodies. Thus in any true systemof physical philosophy, the question of the conservation of energy becomes a vain and useless question, which no one can answer, and which no one has any interest in if it could be answered.

I trust now we have some clear ideas of what we are talking about. Energy is a property of some substance. Dynamic or kinetic energy is the energizing of some force in circumstances which admit of motion. Potential ener-

gy or energy of position is the possible future occurrence of conditions which allow of motion by the energizing of some force.

One point more we will briefly notice. In our definition of energy occurs the phrase, to prevent motion and maintain rest. The energy that is thus employed receives little attention in the dynamic philosophy. Indeed, in its very nature it is limited to the study of moving matter. Moving matter is the only agent in nature, and it cannot go outside of moving matter in its explanations. It is the philosophy of moving matter, and static philosophy, or the philosophy of matter at rest, is left unexpounded. The effort is made, even, to show that there is no such fact as rest, that all matter is moving, and therefore the philosophy of moving matter includes all there is of philosophy. The word motion has no significance, except as the antithesis of rest; and we know that much matter is in that state which has been called rest, as distinguished from the state of motion. Of course, rest means to occupy the same place in space with reference to surrounding bodies. As nearly all definitions have been conformed to current theories, rest has been defined as "the equilibrium of opposing forces." We will consider this definition hereafter.

The extent of the omission in the dynamic philosophy, and the propriety of this clause in our definition, will be seen by a little consideration. We know that we do energize to hold our bodies motionless against the efforts of other forces to move them. All reaction is some force energizing to prevent motion. Cohesion holds the molecules of all solids together to prevent motion. That it does energize to do this we know, because if we attempt to pull the molecules apart, it resists our pulling. The chemical force energizes to hold the atoms and molecules of all compound substances together, as we know by the

large amount of energizing necessary to separate them. The crystallizing force energizes to hold together the molecules of crystals. Gravity holds all loose bodies upon the surface of the earth, and resists attempts to move them. The force of inertia constantly energizes to hold all matter at rest that is now at rest, and to resist any other motion than that which now is. Any attempt to move matter must overcome the resistance of some holding force or forces. In the present age of the earth's progress, there is far more energy employed holding matter at rest and resisting motion, than is employed in moving matter. I do not see how it can be said that this is matter resting in equilibrium between two antagonistic forces. Between what two forces are the molecules of chemical compounds suspended? We might say that molecular repulsion would push them apart, and the chemical force hold them together, but they do not rest in equilibrium between those forces: the chemical force is greatly the stronger, overcomes repulsion, and holds the molecules in actual contact. When gravity holds loose bodies on the earth, between what two forces are they suspended? When inertia holds bodies in their present places upon the earth, between what two forces are they suspended? The force of inertia simply holds bodies where they are, and resists any attempt to move them. That definition of rest seems, then, to be very imperfect, at least.

Now, all these energizings are left entirely out of the dynamic philosophy; and the definition of energy is so framed as to purposely include only the energy of moving matter, and exclude all other energy and energizing. What about this, the greater part of energizing now on earth? Are we to have no account of this? Does philosophy take no cognizance of this? When we take into consideration all the energy that is employed holding

matter at rest, it is evident that the philosophy which has no energy but moving matter, must come very far short of a complete explanation of nature.

I am sometimes met by such statements as this: "These theories which you discard have been mathematically reasoned out, mathematically demonstrated. Can your metaphysics overthrow mathematics?" This seems to be quite an extinguisher. But let us see. Suppose two contradictory hypotheses are both thus mathematically reasoned out to certain conclusions. Does this prove that both of these contradictory hypotheses are true? In this case which shall hold the field, mathematics or metaphysics? It is well known that all mathematical reasoning in science is based upon some hypothesis. The mathematical reasoning based upon that hypothesis does not demonstrate that that hypothesis is true. The case mentioned above often occurs, where two contradictory hypotheses may both be reasoned out to certain harmonious results. The fact that an hypothesis can be thus handled seems to give it a shade of increased probability; and if the conclusions reached by such a process correspond with facts already known by other means, it is quite a strong confirmation of the hypothesis. In that case the mathematician is traveling along the line of our fifth mode of investigation, ascertaining if the hypothesis will explain known facts. But usually mathematical reasoning is not toward known facts, but further into the unknown. Assuming that the basal hypothesis is true, we may by a mathematical process of reasoning ascertain facts in the otherwise unknown. For instance, assuming as an hypothesis the dynamic theory of gases, and assuming as true Avogadro's law that there is the same number of molecules in the same measure, under the same pressure, of all gases, and knowing the relative weight of the molecules of the different substances, we may approximately

determine by mathematical processes the velocity of the molecules of the different gases. Mathematical reasoning in science may increase the probability of the hypothesis, or show that it accords with known facts, or ascertain otherwise unknown facts; but it can never demonstrate the truthfulness of the hypothesis upon which it is based.

CHAPTER IX.

THE PHILOSOPHY OF EVOLUTION.

In a philosophical discussion with an evolutionist I cannot introduce my metaphysics. He does not admit the authority of any absolute truths. He claims to reject all metaphysics; but he has a system of metaphysics of his own; it consists very largely of negations. The fundamental principle of his metaphysics is: We can know nothing of causes or reality. It is not the aim and purpose of philosophy to look for causes. It is not philosophically proper to ask for them, or to talk about them. They are entirely and forever outside of the limits of true philosophy. We are not to take them into our thought, nor allow them to be introduced into our discussion, nor allow them in any way to influence our opinions. After this, evolutionists are freed from the necessity of assigning causes for the doings and changes which they describe; the causal relation can now impose no restraints upon them.

We can know appearances, and nothing more. Nature moves before us as a pictured panorama moves before the audience. We can see the pictures, and describe them and their order of succession; but we are not permitted to inquire respecting the artist who painted them, nor look behind the curtain for the man who turns the crank. The train of clouds floats by, the clouds perpetually involving

and evolving, floating in endless succession, forever changing; we may describe each successive appearance and note the order of succession, and possibly the laws of change; but we must not ask what there is behind appearances, nor why appearances move, nor why they change, nor what moves and changes them. The evolutionist does not admit that he is under any obligations to try to answer these questions; he says they ought not to be asked. It is no matter then if he has motions without movers, doings without doers, changes without changers. The business of philosophy is to describe what can be known through the senses, and to take no thought of what cannot be thus known, nor allow any inquiry or discussion respecting things otherwise supposed to be. We are not to even presume upon the existence of anything else, nor admit that anything invisible has any relation to or influence upon the appearances which pass before us. The only relations admitted to exist are space relations, like and unlike, and succession in time.

The reader recognizes this as that system of philosophy which is called positivism. That this is the metaphysical basis of evolution may be seen, even when not directly avowed, by the definitions given. Take as an example Mr. Herbert Spencer's definition of evolution: "Evolution is a change from an indefinite, inchoherent homogeneity, to a definite, coherent heterogeneity, through continuous differentiations and integrations.*" Here is change in appearances from one state to another state, but no specification of what it is that is changed, and no allusion to anything which effects these changes. It is a description of the kind of changes which take place in the floating panorama of clouds, as before stated. He would be understood as telling the process of change, by "differentiations and integrations," but still no allusion to anything that

*First Principles, p. 216.

differentiates. There is a studied purpose in this definition, and in all the definitions of the earlier evolutionists to ignore and shut out of thought all doers and changers. The word differentiation in this definition is a superfluity and a tautology; of course, if anything changes, it differentiates—defferentiation is only another word for change. This definition then is, Things change through changing; but still no changer.

Take as another example Mr. Darwin's definition of nature: "The aggregate action and product of natural laws; and laws are the sequence of events as ascertained by us."* The action and product of laws; and laws are the sequence of events. Nature is the product of the sequence of events. The sequence of events produces the sequence of events. The sequence of events is something which acts and produces, is it? He meant to say, The clouds float, therefore they float, and we see them floating. He cannot have meant that the sequence of events is a producer.

The aim of evolutionists is to describe the succession of appearances as they pass before us in nature, and to ascertain the laws of change discoverable in this series of appearances. We all notice that things do change. They endeavor to discover some general modes according to which these changes occur. Some of these which Mr. Spencer thinks he has discovered he mentions in his definition of evolution. He concludes that it is a general law that things change from the homogeneous to the heterogeneous, from the incoherent to the coherent, from the indefinite to the definite. Such he concludes from observation and history to be the general modes of change, and he calls these modes laws of evolution. He does not attempt to give any account of what it is which effects these changes; this inquiry is outside of the limits of

*Origin of Species, Chap. IV, p. 85.

philosophy. Mr. Darwin, giving more especial attention to evolution in the vegetable and animal kingdoms of nature, emphasizes a mode of change which he discovers there: The stronger survive; the weaker perish. This he notices as a common fact among plants and animals, and he calls it a mode or law of evolution.

According to the system of philosophy upon which evolution was founded, this was as far as evolutionists were required, or even permitted, to go. They were required to describe the changes which take place, and note the general laws according to which those changes occur. Perhaps we ought to have been content to let evolutionists pursue their way in their path of cloud. They profess to know nothing of doers, and intentionally construct their philosophy without reference to them, and say they do not propose to try to answer the demand for them. As they profess to know nothing of doers, people might have been content to leave them in their acknowledged ignorance, if they had not claimed that descriptions of the passing clouds were complete explanations of phenomena. But people would persist in demanding doers for doings, and changers for changes, and would not admit it to be a complete explanation till these were supplied.

It became necessary to yield to this demand, if evolution was to make any progress among the people. The first move was to supply the appearance of doers, though in fact no doer was supplied. This Mr. Darwin did first in the name which he gave to the fact of the survival of the stronger. He called it "natural selection." Selection carries with it the thought of selecting and selector. Selection implies intelligent action, a knowledge of two, and choice between them. Thus there was produced in the mind of the reader the illusion that he had supplied an actor and a doer, and men could read of the doings of natural selection without any painful feeling of unsatisfac-

tion because of the demand of the mind for a doer—natural selection is the doer. Only those who saw clearly enough to see that this was only a name for a mode of change, and that no actor or changer was really supplied, felt any deep dissatisfaction at representations of the doings of natural selection.

But Mr. Darwin fostered this illusion, not merely by giving this name to a fact, but also by continually using language expressive of acting and doing in connection with the name. Thus in his description of how an eye may be formed* he has natural selection "always intently watching," and "carefully preserving," and "picking out with unerring skill." These words, watching, preserving, picking out, and skill, can be used only in reference to an actor, doer, an intelligent doer. He thus deepens the impression of a doer, and carries the reader along in the illusion that he has met the demand of the human mind for a doer. I do not say that he thus intentionally tried to deceive people. It seems rather probable that, wishing to show the competence of natural selection for this work, and feeling in his own mind a demand for these powers to make it competent, he created this illusion in his own mind, and did not look at it closely enough to see that he had endowed it with powers which it came far short of possessing. When called to account for such use of language, he said he was only personifying the fact that the strongest and best fitted survive. But if we take out of the explanation these personifying words, it ceases to be any explanation at all,—only a thing really possessing these powers could accomplish this work, while that which he endows with these powers is simply a fact, and not a thing at all, possessing no power at all. It seems that Mr. Darwin did not have clear conceptions of what constitutes a doer; through all his writings he is

Origin of Species, p. 181.

constantly treating modes or laws as doers, and giving them active, productive, creative power. Whether this be a mistake or an intention to deceive the unwary, every one must judge for himself. He and other evolutionists often use the words differentiate and differentiation so as to produce the impression that they are agents possessing active and effective power, instead of the mere fact that a change is now occurring, or that a change has been effected by something.

The demand for changers was further yielded to in the introduction of the word environments. These, physical surroundings, dietetic and climatic influences, etc., were introduced as changers, causes of change. Then the philosophy of evolution borrowed many of the doctrines of current physics. The theory that the inorganic forces are physical motions, the theory that moving matter is the only doer in nature, the theory of the conservation of energy and the convertibility of the different forms of energy, were adopted and made to include vegetable and animal life, the physiological forces and instincts of brutes, and the mind and mental activities of man. These were all decided to be physical motions. Then the way was fully open for the introduction of causes into the philosophy of evolution. Causes were excluded at first because they were supposed to be invisible. The rule was that nothing should be introduced into philosophy or sought for that is not discoverable by the senses; that rule was supposed to exclude causes. Now that all causes operating on earth are supposed to be material, and matter is discoverable by the senses, causes may be freely used in philosophy. It is no matter whether causes are excluded from or included in philosophy, if only the divine is excluded.

Evolutionists had now attained to a position where they could freely use causes, and talk, as other philoso-

phers, of the causal relation. The causal relation which they adopt is that of precedent and sequent—the cause is that which uniformly precedes, the effect that which uniformly succeeds—or else the law of continuity—the cause and the effect are the same substance in precedent and subsequent states. Either of these will answer, and one or the other may be used as it will most favor the case in hand. No other doctrine of cause is admissible, for all causes are physical, and all that is and all that occurs, all agencies and all influences, even those which we have been in the practice of denominating mental and moral, are all reducible to the laws of physics and mathematics.

The causal relation is now exalted into wonderful importance. Everything that has appeared since the world of fire cooled off, is the effect of natural causes, and natural causes are matter in motion and at rest—or in motion, for there is no rest. Matter in various forms of motion is all there was at the beginning, and all that ever has been, and all that ever will be. The various forms of moving matter, interacting, brought forth the beginning of life. The various forms of moving matter, interworking, developed from that successively higher and higher forms of being. The various forms of moving matter have wrought out the history of earth, and the history of the human race, and they will continue to develop these to their final destiny.

Everything that ever has been was a necessary effect of natural causes. Everything that is, is a necessary effect of natural causes. The causes existing and acting, the effects necessarily follow. Nothing in the past could have been otherwise than as it has been, nothing in the present could have been otherwise than as it is. Nothing in the future can be otherwise than as the causes around it make it to be. This includes the bodies and minds of men, their forms, natures, and characteristics. It in-

cludes also the activities of mind and body. No one can think otherwise than as the causes make him to think. No one can believe otherwise than as the causes make him to believe. No one can will otherwise than as the causes make him to will. No one can do otherwise than as the causes make him to do.

The peculiar organization of each individual brain is the result of environments in the midst of which it has come to be. The molecular motions which we call heat outside of the brain, become another form of molecular motions in the brain, and these are mind and these are our thoughts. If diverse environments produce different brain motions, we have different thoughts and different beliefs. Our thoughts and our opinions are necessary effects of surrounding causes. One man is made by his environments to think and believe one way, and another man is made by his environments to think and believe directly the opposite, and there is just as much truth and certainty in one as in the other. One set of causes has just as much authority as the other, or any other. One belief is just as valid as the other; both are produced by their causes; both are positively necessary; neither could possibly have been otherwise than as it is. Each man's opinions are to him true. The fact that the opinions of two men are contradictory is no disproof of either, for not even the law of contradictions is any test of truth. One opinion is just as true as any other. All opinions accord with the causal facts which produced them. Then there is no such thing as truth or falsehood, no reasonable and no unreasonable, no rational and no absurd.

Then, according to all principles which men have agreed upon as conditions of responsibility, man is not a responsible being. Every man thinks and believes and does as the surrounding causes compel him to think and believe and do. Then no man is blamable for whatever

he may think or believe or do. The causes made the thief to steal, and he could not help it. The murderer was only an instrument in the hands of causes; he is not at all to blame. The anarchist can truly say, It is utterly a tyranny and a wrong to hurt a man for whatever he may do. You call stealing a crime. We call accumulating a large amount of property a crime. One is as great an evil as the other. We have the same right to punish you for being rich that you have to punish us for stealing. There is no right or wrong about it. No man has any more right to govern than any other man. The judges are the criminals. Jails and penitentiaries are engines of crime. The criminals are those who put men there for acts which they could not avoid doing. Lawmakers are tyrants. Governments are hyenas devouring mankind. I have the same right to shoot the sheriff for his acts that he has to put me in jail for stealing. The causes make one man to build a fine house. The causes make me to burn it. The causes make one man to accumulate a large amount of money. The causes make me to knock him down and take it from him. He was as much to blame as I. The philosophers of evolution have given us the principles upon which our philosophy, our political economy, and our sociology are founded. You will please reserve your denunciations of us while you teach us the principles.

Again, as all opinions are necessary effects of physical causes, the opinions against evolution are just as valid and certain as opinions in its favor. Truth is only to the man who thinks it. The opinions of one man are to him truth; the opposite opinions of another man are to him truth. The evolutionist cannot ask another man to think as he does. He certainly would not think of asking me to believe his theory, while he asserts that both his and my opinions are necessary effects of our diverse environments, and that my opinions against it have the same foundation

that his have for it, and that mine are just as valid as his.

This doctrine renders all truth and knowledge unattainable, and all science impossible. There can be no established principles of science, for each one thinks as the environments make him to think. No science or philosophy can be common to any, except those who happen to be subject to the same environments. There can be no system of truth which can claim, above all others, to be the truth. No theory or system is any more valid than any other theory or system. Even evolution cannot claim to be a true system; it rests only upon the fact that the peculiar organization or peculiar environments have made some men to so think, while the mass of mankind have been made by their environments to think otherwise. Thus the system buries itself at last, with all other science, in the grave of nothingness.

This is evolution. It is built upon the foundation of the exclusion of all invisible doers. It assumes that matter, with the help of natural causes, can evolve itself into new forms, into all the forms in which matter appears, and into all the forms of being and life which are found on earth. The essential feature of evolution is the evolving of matter by its own power and forces into new forms of being. Evolution means self-unfolding, self-producing. This is what those who adopted the word and constructed the system meant by it. Any system of belief which does not embrace this thought, which does not have matter self-evolving, which introduces any agent from outside of nature, is not evolution. What is called theistic evolution seems to me to be clearly a misnomer. It is not evolution at all, but a theory of the mode of divine creation. In evolution nature does it all; in theistic evolution the divine Creator does it all. Why the same word should be used to name two systems so directly contrary to each other, I do not know, and it seems to me to be very un-

wise. It is not only a philosophic impropriety to call things so unlike by the same name, but it is misleading, confusing the public mind, and giving to the word evolution a respectability which does not belong to it.

In preceding pages we have seen that the pillars upon which the evolutional system of philosophy rests—that matter is a doer, that the inorganic forces are moving molecules, that they are convertible into one another—are not found in nature, and if these supporting pillars are removed how can the edifice stand?

CHAPTER X.

THE SOLUTION.

We have found in our investigations that in all processes of doing in nature, in all natural phenomena, except where one body moves against another body and starts that in motion, the doing is accomplished across intervals of space, where the matter that is supposed to do is not, and therefore that matter cannot be the doer in any of these cases. From these facts we made the generalization that matter is never a doer. We have subsequently found that in the excepted case—inertia—there were many evidences that there was a mover in the matter that is not the matter, which has its own peculiar and distinctive properties and modes, which indicate a *sui generis* substance. In all the other cases we have to suppose some immaterial substance which extends and reaches across these intervals of space, which is the doer. If we extend this supposition to the excepted case, as facts seem to indicate, and suppose that there is in matter an immaterial substance which acts according to the modes there manifested, we see that this case can be fully and perfectly explained without supposing matter to be the doer. In all other cases matter cannot be the doer; the supposition which we are compelled to make in the other cases perfectly explains this.

We have also found that that whole system of physical philosophy which has dynamic energy for the doer in-

volves the absurdity of counting doing, energizing, a relation, as a doer, and has energizing without an energizer. In all that system of philosophy, laws, modes, motion, and energizing, are spoken of as doers, and the whole universe is an eternal pushing without any pusher, and an eternal pulling without any puller.

Some of the sources of this stream of philosophy are found in the remote past, but its largest tributary appeared when it was asserted that heat is a mode of motion—motion without any mover. When the public and scientific consciousness became adapted to the thought of a perpetual moving without any mover, in case of heat, the stream soon became broad enough to embrace all physical philosophy. The well known fact that matter started in motion, if unobstructed, moves perpetually in straight lines, is manipulated and expanded into a universal mode in nature, embracing all kinds of motions, in all possible circumstances, and in the midst of constant obstructions. Matter does not move perpetually, even in straight lines, and in the absence of obstruction, without a mover; there is a mover there, and that mover is not matter. What folly to talk about bodies of matter moving perpetually in the midst of perpetual obstruction! Then a well known law in mechanics—the constant quantity of work which a certain amount of energizing will accomplish—passes through the same transforming process, and is metamorphosed into an eternally flowing current of energizing, and by their belief in one thing men are made to believe in an entirely different thing.

Heat is a mode of motion. What is the mover? The molecules have been knocked, and now they go on moving forever, in the midst of constant obstruction, and constantly changing their directions. Many of those who elaborated this theory did not deem it necessary to look behind motion for a mover, and many others have received

the theory on the authority of their teachers and their text-books, without considering its *a priori* possibility. (See page 97.) Then, as there is some heat in all matter, the molecules of all matter must be detached bodies, in perpetual motion, and we have what is called the dynamic theory of matter. Light is said to be eternally flowing waves of matter. What moves the matter? Some of its atoms have been knocked, and they knock others, and they others, and thus the waves move on forever, a perpetual motion in the midst of obstructions, without any mover. Then the constant energizings which are going on in nature, by which matter is constantly moved, were named energy, as though they were a substantive thing and doer, and the theoretical framework of modern physical philosophy was erected.

As we have seen in preceding pages, this system meets with many difficulties—not only with phenomena which it is unable to explain, but also with what appear to me to be impossibilities.

Now there are ways of obviating all these difficulties. Doers may be supplied in all these cases. This may be done by supposing that God is the universal doer, and that all motions in nature are the effects of His energizing, and that all dynamic energy is His constant energizing. This is the opinion of many theologians and some scientists and philosophers. A competent doer is by this supposition supplied for every doing in nature. No one questions the competence of this supposition to explain all natural phenomena.

It is surprising to hear some men advocate this theory, and at the same time adopt and maintain the current theories of science. That theory and these seem to me to directly contradict and exclude each other. The dynamic theory of matter, for instance, declares that the molecules of all matter are in constant motion, and that molecules

and masses once started in motion, no matter what the form of motion, nor what the circumstances, move of themselves forever afterwards, unless they impart their motion to other bodies. The theory of divine doing declares that matter never moves of itself, never moves except as God moves it. One theory says, matter moves itself perpetually; the other says, matter never moves itself. How can any one mind embrace and support both of these assertions? The dynamic theory of heat also asserts that molecules of matter move themselves perpetually. This theory declares that matter never moves itself. Yet many who hold to this theory of divine doing, embrace, defend, and teach the dynamic theory of heat. Thus they have in their creed both members of a direct contradiction. The undulatory theory of light also includes the endless self-perpetuated motion of matter, and involves the same contradictions with this theory. If the motion of light is the doing of God, what need is there of supposing an ether between the sun and the earth. God can move through space without any ether to move in. The theory of the self-persistence and constant equivalence of energy also contradicts the theory of the divine doing. Yet many who hold to this theory, hold also and maintain that theory. If we have in our creed both members of a contradiction, we would be wiser if we threw one of them away.

The theory of the divine doing meets all the requirements of the case, and is sufficient for all demands that may be put upon it. But it is not to the human mind the most satisfactory way of explaining nature. It seems to be almost instinctive to look for natural causes. Men of all religious creeds, the most devout as well as the most profane, have in all ages been trying thus to account for and explain natural phenomena. Perhaps our own modes of doing incline us to thus think of God. We do largely

by the agency of others; especially is this true of sovereigns and those in authority. It seems to us to be a derogation of His dignity as sovereign of the universe to suppose Him constantly engaged in the details and minutiæ of doing that is going on in nature. This seems to be a laborious and toilsome way. It is not as we would do if we possessed all power and authority. Whatever be the reasons for it, mankind do constantly look for intermediate agents and finite doers in nature; and the most of mankind have always looked, and probably always will continue to look, for them and believe in them.

If we suppose that the different forms of energy operative in nature are emanations from God, detached, and objective to him, now running on of themselves, we suppose an absurdity; for energy is a property, and nothing but substance can be detached, and exist apart and independent.

If we suppose that God has started currents of dynamic energy, and then, ceasing to energize Himself, allows those currents to flow on of themselves, we suppose another absurdity; for dynamic energy is only the energizing of some substance, and the moment that that substance ceases to energize, the dynamic energy ceases to be.

What supposition can we make that will meet the demands of the case, and still allow us to have finite agents as doers in nature? *These agents must be immaterial substance;* for we have seen that their work is such, and in such circumstances, that matter could not do it; or if they were matter extending across the intervals of space which separates bodies, we could detect its presence. If we suppose that God has created some finite immaterial substances capable of performing this work, we could meet all the demands of the case. They must be substance that they be capable of detached and independent existence, and that they be doers. They must possess the property

of energy that they be capable of moving themselves and moving matter. They must possess other properties or modes of action, each of its own kind, to qualify it for its specific work. By such a supposition we obviate all the difficulties we have met with in any physical theory, supply doers in all natural phenomena, and yet satisfy our demand for second or natural causes, and leave an opportunity for science.

It is thought that all phenomena in inorganic nature can be attributed to ten doers. They are gravity, inertia, cohesion, chemical attraction, molecular repulsion, electricity, magnetism, the crystallizing force, heat, and light. These cannot be matter in any state or form. It is impossible to explain a hundredth part of the phenomena of nature on this supposition. Then, as we have seen, in a very large proportion of natural phenomena it is utterly impossible that they should be matter. All doers are substance; they are not material substance; then they are immaterial substance. Each one of these ten is a specific kind of immaterial substance. They are discovered by their doings, and distinguished from each other by differences in their doings. As each material substance has its own distinctive properties which characterize it, so each immaterial substance has its own modes of action which characterize it. The properties of matter are passive, and are discovered through various processes. The properties of immaterial substances are active, and we call them modes of action. Their properties are inherent in them, and are never imparted to them by any finite agency or physical circumstance. Gravity draws matter together because that is its nature, its increated mode of action. Cohesion holds molecules together in masses. Chemical attraction unites molecules and atoms together chemically. The crystallizing force places atoms and molecules together in the form of crystals. Each does work of its own

kind with matter, because of its own increated mode of action.

Material substances are distinguished from immaterial substances by their properties. Matter has weight and inertia, and is impenetrable to other matter. Immaterial substance has not weight nor inertia, and it is penetrable to other substance, to matter. Material substance has not, and immaterial substance has, the property of energy. These forces are not fluids, gases, vapors, or moving molecules. All these have weight, and are in their ultimate particles impenetrable. It is probable that each force exists in connection with the earth in unchangeable quantity, except as heat and light pass away into space. We cannot create one of them, nor add to the quantity of any one of them, nor make that quantity less. But many of them may lie in a quiescent, latent state in matter, when they are not discoverable by us. Producing them, as it is generally called, is only bringing them out from their state of latency into activity, when they become discoverable by us. In their unchangeable quantity they are like the material elements. The quantity of iron, carbon, oxygen, and so forth, is unchangeable. This is equally true of the immaterial substances. One of them is never converted or transformed into another. We might as well try to change iron into gold, or oxygen into hydrogen, as to try to change one of the inorganic forces into another. Each possesses its own invariable properties, and exists in its own unchangeable quantity.

Some persons profess to be unable to obtain a clear conception of immaterial substance. This difficulty has been greatly increased by the philosophy which denies extension to immaterial substance. We can have no conception, in the sense of image in the mind, of anything which has not extension and form. In giving to all substance, in our definition, space relations, we allow to immaterial

substances extension, form, and size. We can form a conception of that which has size and form.

The difficulty of obtaining a conception of immaterial substance has been increased also by the philosophy which denies all knowledge of even material substance. I think that we know material substance immediately through the sense of touch. We discover that there is something which fills space to the exclusion of other matter. That which we find to thus fill space to the exclusion of other matter, we call substance. We know it as space-filling, other-matter-excluding substance, before we know any of its properties, or anything else about it. We susequently discover its form and size. We are able then to form a conception of it as a space-filling thing with form and size.

We have now a conception of material substance. We know it as something filling space, excluding other matter, with a definite form, and a discoverable size. Let us now subtract from this knowledge one of these four facts—impenetrability—and we have a conception of it as space-filling substance, with size and form. It is true that property which enabled us to first discover it is gone, but we can conceive it there, having the same size and form, filling the same space, yet allowing other substance to enter that space. What is it that we now have a conception of? It is substance filling space, yet not excluding other substance from the same space—that is, it is immaterial substance.

Here is a block of crystalline marble. There is, first, the material substance which we call marble. Dwelling in it, occupying the same space, of precisely the same form and size, is another substance, an immaterial substance, which we call cohesion. This substance holds the molecules of the material substance strongly together. Within the marble, occupying the same space, of precisely the same form and size, is another immaterial substance which

unites and holds the atoms of calcium, oxygen, and carbon together to form the marble. This substance we call chemical attraction. Dwelling in that marble, occupying the same space, of the same form and size, are other immaterial substances—inertia, the crystallizing force, electricity, magnetism and molecular repulsion, each united to the marble by attraction. Within that marble, occupying the same space, united to it by attraction, but extending indefinitely beyond its bounds, is another immaterial substance, which we call the force of gravity. Within that marble, occupying the same space, much of it remaining there, undiscoverable by us, but some of it letting go of the marble and flying away from it, is another immaterial substance which we call heat, and another which we call light.

If we believe in mind as an immaterial substance, we can aid our conception of immaterial substances by comparing them with mind. The mind occupies the same space that the body does. Mind and the inorganic forces are alike in that they both are imponderable and penetrable, both possess the property of energy, and both are united to matter. The inorganic forces are unlike mind, in that they do not possess sensibility, intelligence, or will.

We have stated that these forces are joined to matter by attraction. Of course, the ultimate how of this attraction no one can explain. Here we enter the department of properties, where no one professes to give any explanation. We cannot see how one substance can be made to possess one property, and another substance another property. One substance possesses a property by which it joins itself with and clings to another substance. We call this attraction. Different portions of the same immaterial substance cling together. We call this attraction. We say they do so because such is their nature, their property, their mode of action. This is as far back as we can go in

our explanations. I can see no explanation back of that, or reason why they are so, or do so, only that such properties or modes of action their Creator saw fit to give them.

(In the original manuscript I had here written over a hundred pages applying this theory to natural phenomena in all their details. In that trial of the theory I found it competent to explain natural phenomena more perfectly and more completely than any other theory which has been proposed, except, of course, the theory of immediate divine doing. But I have thought best, in this abridgement, to omit all this, and dismiss this branch of the subject with only a few words.)

As we know the forces by their doings, as we deduce their properties and powers from their doings, of course we can give to each force properties and powers which render it capable of performing the work that it does. The only test in such a process is contradictions, as when, by giving it properties which render it competent for one part of its work, we destroy its competence for another part of its work. It is thus that the hypothesis of a luminiferous ether is shown to be untenable. When it is fitted for the transmission of light, it becomes impermeable to the worlds. When it is modified so as not to be an obstruction to the worlds, it becomes incapable of transmitting light at its known velocity. When a true explanation of facts is hit upon, no such contradiction can occur. In applying and testing this theory in all the details of scientific facts, I found no such instance of contradiction. On the other hand, I was often surprised to find how perfectly an inference made from one set of facts harmonized with all the other facts. I will mention one or two instances of this kind. The specific heat of water is greater than that of any other liquid or solid. Inference from this: Heat has more attraction for water than for any other liquid or solid. Now test this inference in other

phenomena of heat in relation to water. It absorbs more transmitted heat—heat stops in it; it is a poor conductor—heat moves slowly through it; it is a poor radiator—heat clings to it; it is a strong refractor—heat is retarded much in its passage through it. Thus we find that all the other classes of facts corroborate the inference. Another instance: The specific heat of the metals, as a class, is low. The inference from this is: Heat has little attraction for the metals. Test this inference by other classes of facts. The metals are good conductors—heat passes rapidly through them; they are good radiators—heat leaves them readily and rapidly; they are good reflectors—much heat turns away from them. I found very many such instances, and none where a contradiction appears.

Under the guidance of this theory many new facts are discovered, and many old ones verified. I will mention a few facts. Gravity and inertia have an equal attraction for all kinds of matter. All the other forces have unequal degrees of attraction for different substances. Heat and light have an attraction for some substances, and a repulsion for others. Some portions of the same beam of light and heat have an attraction, and other portions a repulsion, for the same substance. The chemical force is an attractive force only. The difference in quantity of this force in different substances determines their relative attraction for each other;—those two substances which have most of this force in them are attracted together most strongly. (The opinion here expressed is largely hypothetical, it not having been fully tested by experiment.) There are, however, many circumstances which modify this rule in practical use; such as electrical state, distance, solution, chemical bonds, or relative position of the atoms to each other, and so forth.

Some of the forces are simple, and others compound. There are two kinds of electricity, and two kinds of mag-

netism. As this is the common opinion of scientists of the present day, I need say no more about it. There are at least three kinds of heat, distiguished from each other by different degrees of attraction and repulsion for different substances. They are discovered and separated from each other by reflection, absorption, and transmission in the same substance. Let a beam of radiant heat fall upon the surface of water. Part of it is reflected away from that surface; that is one kind of heat; part of it stops in the water and raises its temperature; that is another kind of heat; and part of it passes through the water; that is another kind of heat. That this is a separation of particular specific kinds of heat appears from the following fact: The heat which has passed through water will pass through ice without melting it or raising its temperature; all the heat which has an attraction for water in any form has stopped in the water, so that none of it stops in the ice to warm it.

There are three kinds of light discovered and separated in the same manner. Let a beam of light fall obliquely upon a plate of glass; part is reflected from the surface of the glass; part is absorbed in it, and part passes through it. The first is a kind of light which has a repulsion for the glass; hence it turns and flies away. The second is a kind of light which has so strong an attraction for the glass that it clings to it and remains in it; the third is a kind of light which has not sufficient repulsion for the glass to turn it away, nor sufficient attraction for the glass to stop it, so it goes on through. If the light strikes the glass at a very acute angle with its surface, more of the light will fly away from it. If its angle with the surface is obtuse, more of it will be by its velocity and tendency to straight forward motion driven through, even some which has sufficient repulsion for the glass to at other angles turn it away. If the light strikes the surface

of the glass at a certain angle, the light separated from the beam by reflection is what is called polarized light. The same portion of the light is separated from the common beam by refraction in plates of tourmaline, Iceland spar, and some other substances. I see no necessity for supposing that any change is effected by these means in the nature of the light. I think all the facts involved can be explained by understanding that this is merely a separation from the common beam of a certain kind of light. Polarized light, as it is called, is, then, only a certain kind of light which exists in the common ray, but which is separated from the other kinds by these means.

There are also three or more kinds of light which are distinguished from each other by color. Red light is one kind of light, blue is another kind, etc. Color in bodies is explained by different degrees of attraction and repulsion which the different color kinds of light have for different substances. For one body all the light in the beam has an attraction, except the red rays; all the other rays pass into the body and remain there; the red rays, having a repulsion for that matter, turn and fly away from it, and we call it a red body. The same facts apply to the explanation of the other colors.

This theory changes our concepts respecting many natural processes, and the meaning of the words by which they are designated. Thus the words conduction, reflection, refraction, transmission etc., imply that the involved matter is the doer, whereas matter never does anything; the forces are the only actors. No conductor is necessary for heat or electricity. Heat passes away from a hot body much more rapidly in a vacuum than in the air. Radiated heat moves much more rapidly than conducted heat. Heat and light have a natural mode of motion, which is in straight lines through space, at a certain definite and fixed and great velocity. All forms of

matter are more or less obstruction to them, and retard their velocity more or less. They are retarded by their attraction for that matter. For some substances they have a stronger attraction, and are retarded more; and for some substances their attraction is so great that they stop in it, attaching themselves to it. Bodies are opaque to light, not because the light cannot pass through them, but because the light has so strong an attraction for them that it stops in them and remains attached to them. It is not that certain substances are good conductors of heat, but as heat has less attraction for them, it is retarded less in its passage through them. Electricity needs no conductor; through perfectly empty space it would pass more freely and rapidly than through any substance. Through the partial vacuum which man can make it passes much freer and farther between the electrodes than through the air. The purpose of conductors is to make an opening through the air, which is an absolute obstruction to electricity. The combined electricity is so strongly attached to some substances that it cannot be decomposed in them nor moved from them by the process of induction; hence there can be no transmission through them. Such substances are called non-conductors. The combined electricity in other substances is more loosley joined to them —has a weaker attraction for them—and any decomposed portion of electricity near them, decomposes the electricity in them, drawing the opposite kind toward it, and pushing its own kind away from it. Then there are portions of decomposed electricity in that end of the conductor. These separated portions in the conductor decompose the electricity in the contiguous part of the conductor, or wire, and that decomposes a portion further on, and that a portion still further on, and so on through the whole length of the wire, whatever be its length. If the starting electricity is positive, the negative electricity

through the whole length of the wire is shifted one step toward that end of the wire, and the positive electricity through the whole length of the wire is shifted one step toward the other end of the wire; the result is that there is some free positive electridity at the other end of the wire to be utilized. If the circuit is completed, and the process continued, the results are a current of positive electricity flowing in one direction, and a current of negative electricity flowing in the opposite direction. These are the facts as demonstrated by experiment; and for these facts, these two currents of electricity in oppsite directions, the physical theory of electricity has no explanation.

There are many other natural phenomena for which the physical theory of the forces can give no explanation, which are perfectly explained by this.

Reflection of heat and light is explained by supposing that the portions of heat and light which are reflected—as it is called—have a repulsion for the bodies from which they fly away. For the substances in which they are absorbed, they have an attraction. If that attraction is sufficiently strong to overcome their disposition to move forward in straight lines, they stop there permanently, and remain there insensible to us, become latent. It was long ago thought that heat did thus go into a state of latency; it appears to be quite as common a fact with light. We too might talk about storing up the sunbeams of the geological ages in the coal beds, not storing energy, a property, which is nonsense; but storing up the substances which we call light and heat. When the attraction of heat and light for the material substances is such as to hold them less strongly, they slowly move away from those bodies, assume their natural mode of motion, and become sensible to us. Heat is sensible to us, and discoverable by us, only when it leaves other bodies and en-

ters our bodies. This is called radiation. When the disposition to move forward in straight lines overcomes its attraction to the bodies, heat moves away from those bodies. This is a very familiar fact in reference to heat. Some cases of it in light are known. Phosphorus is often luminous without combustion. The firefly, the glow worm, some kinds of fish, and sea insects, and luminous paint, are instances of luminosity without combustion.

These are cases where the latent light in bodies passes away from them without change in temperature. When substances are heated to a certain temperature, light ceases to be bound by its attraction to them, and it bursts away from them in floods, and commences its normal flight.

Refraction is the result of an attraction for the substance which is sufficient to retard, but not stop, the light and heat. When a beam of light strikes obliquely upon the surface of a plate of glass which has parallel surfaces, the lower edge of the beam touches the glass first and is retarded first, and the other portions of the beam in succession, and the result is that the face of the beam is turned downward. When it emerges from the glass, the lower side of the beam emerges first, and resumes its normal velocity first, and other portions of the beam in succession, and the result is that the direction of the beam is restored to its original. This is the explanation given in the physical theory; but the reason of its return to its former direction here—its normal velocity—is far more satisfactory than that given in the physical theory.

As I have declared that the physical theory of the forces is impossible because the work is done through intervals of space, it is perhaps incumbent upon me to explain how this difficulty is obviated in this theory. Gravity extends in unbroken continuity through all the region of

our solar system, it may through all the stellar space. But we do not know that the different solar systems have any attractive power upon each other, although it is supposed they have.

In the supposition of a material ether it was necessary to extend it to all suns from whence light comes to us. In this theory the immaterial substance which we call gravity, may extend to only the limits of each solar system, binding and holding all its members together, but not reaching to other systems. It is certainly a no wilder supposition to suppose that an immaterial substance fills all this space, than to suppose that a material substance does, while this obviates all the objections of its imcompetency, and its obstruction to the passing worlds.

Molecular repulsion, while it centers in the molecule as a nucleus from which it radiates, extends a certain distance beyond the limits of the molecule and pushes others away from it. Magnetism and electricity, the two kinds united together, fill all bodies. A magnet decomposes the magnetism of the intervening air, and it probably extends to a limited distance beyond the limits of the magnet, and outside of the limits of the molecules of air, so as to make it continuous magnetic substance from one magnet to another. All electrical attractions and repulsions are accomplished through nonconductors. The electricity of the air, and other nonconductors cannot be decomposed by other electricity; but it appears to use the electricity of the intervening nonconductor to push and pull the electricity of a body from which it is separated by that nonconductor. At all events, in the cases of both magnetism and electricity, they fill all the space between the body where the action is, and the body where the effect appears, and we are not guilty of the absurdity of having substance doing where it is not.

I present here these few hints merely as indications of the explanations which are possible under this theory. In going over the whole field, I find no natural phenomena that are not as well explained as by the physical theory, hundreds of phenomena that are better explained by it, and many others that this will explain which that cannot. Then we must remember that the effort of explanation of phenomena under the physical theory has been prosecuted for a hundred years, by all the most learned and able scientists of the age, while this has been but briefly considered by only one, and that one claims nothing but an ordinary degree of common sense. I invite the severest testing by practical scientists; but if they commence their investigations by ignoring and shutting out metaphysics—absolute truths—I shall claim to have a far higher source of information than they, and a far more conclusive test of truth. Or if they claim to know only appearances, I shall claim to have a much more intimate aquaintance with things than they have.

In the next chapter we will, from the standpoint to which we have now attained, consider the causal relation as it exists in nature.

CHAPTER XI.

Causes in Nature.

In the foregoing pages I have avoided the use of the word cause. I have done so because the word has come to have so many significations that it suggests no definite thought to the mind. I have substituted the word doer as the name of Aristotle's efficient cause. If we use any other word instead of cause while discussing the causal relation, it may not be recognized as that which others mean by the causal relation. We use the word as synonymous with doer, and define it as follows: A cause is that which energizes to produce motion or effect change. These words also define doer, and because of the uncertainty in the meaning of the word cause, I think it better generally to use the former word. However many meanings we may attach to the word cause, in considering the causal relation we can mean only Aristotle's efficient cause, or a doer, or that which energizes to produce the effect.

Mr. Hume said respecting causes: "It is impossible to point to any one quality which universally belongs to all beings, and gives them a title to that denomination." This is true if we take the word cause in all the dozen meanings which have been attached to it. But if we limit it as above, use it in the sense of doer, that which energizes, it is not true. We can say, a cause possesses the property of energy, and nothing else in the universe does

possess that property. All things in the universe are thus at once classified into causes and not causes. All existences which possess the property of energy are causes; and all things in the universe which do not possess the property of energy are not causes. There is never any crossing of the line which separates causes from non-causes. Nothing that is not now included in the class causes can ever be made to become a cause. No such process as imparting energy to a body, or of transferring energy from one body to another, is possible. Things that were created causes remain such through all the ages. Things that were not created causes can never become such by any agency less than creative power. Man can never bestow a property, or create a property, any more than he can create a substance.

This single classification clears away at once much of the fog that has enveloped this subject. Everything that possesses the property of energy is a cause. Is this thing a cause? Does it possess the property of energy? That question may be determined by experiment, or by an examination of facts. If it does not possess the property of energy, it is not a cause, and never can become a cause. In ascertaining the cause or causes of any change or phenomenon, all we have to do is to discover what things connected with the phenomenon possess and exert energy in that case. Nothing can produce motion or effect change but by the exertion of energy. Nothing can exert energy that does not possess it. Nothing can be a cause of motion or change that does not possess the property of energy.

We may limit our classification still further. Nothing but substance can do. Then all doers, all causes, are substance. If the property of energy is involved in all causation, we know that that property cannot exist except in connection with substance. The substance is the

doer or cause. Every cause is something which of itself occupies space. Then no property, or attribute, or relation, or event, or phenomenon, can be a doer or cause.

We have found in our examination of phenomena in preceding pages that those things which possess the property of energy do not possess the properties of weight, inertia, and impenetrability. We have found the property of energy uniformly associated with imponderability and penetrability, never with ponderability and impenetrability. From these facts we are able to make these generalizations: All causes are immaterial substance; material substance is never a cause or doer. These are generalizations from observed facts; and, as there are found no exceptions to them, they are generalized universals.

And now, is this definition of cause the true expression of the causal relation, as it appears in our consciousness? All philosophers of every school admit energizers among the causes, but some of them admit many other things. All mankind look upon things as causes when they energize to produce effects. The word doer is by all limited to such. We learn the process of doing by our experience as doers. Every man calls himself a cause when he energizes and moves something. We know by our experience that we are thus related to the effect. We know that if we move our bodies, or move any matter outside of our bodies, or effect any change whatever in things around us, we do it by the exertion of energy, and that without the exertion of energy we do nothing, effect nothing, cause nothing. The essential, always present element in our consciousness of ourselves as causes is energizing. We know nothing about energy, or energizing, or causation, in things entirely objective to us, except by transferring this subjective knowledge to objective things. We know that objective things which move us, exert energy upon us. We can have no conception of our-

selves as causes, nor of objective things as doers, causes, without including energizing as one of the elements of that conception.

From our experience of ourselves as causes, and from our experience when external things move us, we conclude that energizing is always present, and is always the nexus between cause and effect in objective natural phenomena, when both the cause and the effect are objective to us. But this correspondence between the subjective and objective causative process need not here be admitted as an *a priori* fact. We have learned, by the action of objective things upon as, and by our action upon them, when, and in what circumstances, motion, effects are produced. We have thus the mode of the causative process in our minds. Now we can go out among objective phenomena with this subjective mode fixed in our minds, and what we find in objective nature which corresponds with this mode we will classify under it. As we energize when we are causes, as things energize upon us when they move us, we will classify all things we find in objective nature which energize, or possess the property of energy, under the name causes. We will not here argue from the subjective mode that such are the facts in objective nature; but what we find by observation to actually correspond with this subjective mode, we will classify under it. Then if we will go to work and ascertain what does and what does not possess and exert energy, we can make our classification complete.

This is what we have been endeavoring to do in preceding pages; and we think we have found it a plain and evident fact that nothing on earth possesses the property of energy but immaterial substance, and that therefore immaterial substances are the only doers, causes, in nature. If others are not prepared to admit this, if they think that some material substances possess and exert energy, they

would place such in the class causes. Whatever we find that possesses and exerts energy belongs to the class causes, and everything else is excluded. I am confident, however, that nothing on earth does possess and exert energy but immaterial substances. The definition of cause which we have given agrees with our intuition of cause, and our experience of causation, and as we know nothing of any other causal process, these should regulate and determine our classification of causes, and nothing in objective nature should be called a cause that does not agree with our experience of causation.

We are now prepared to formulate the causal relation, and express it in an invariable, universal, and infallible formula, applicable to all things, in all space, and in all time. That formula is this;

CAUSE; ENERGIZING; EFFECT.

The necessary connecting link between cause and effect, so often demanded, is here supplied, and the chasm which was the central point of Hume's destructive criticism is bridged. He said that if the "necessary connection" between cause and effect can be shown, "I shall frankly give up the entire controversy." The necessary connection is the energizing of the cause to produce the effect. It is a necessary connection. The energizing must be there, or else the causal relation is not there, and the two do not stand in the relation to each other of cause and effect.

We will test this by a table of examples in which the causal relation is absent.

Water;———; ice.
Morning;———; noon.
Day;———; night.
Spring;———; summer.
Clouds;———; rain.
Motion;———; another motion.

Law;———; phenomena.
Natural selection;———; development.
Homogeneous;———; heterogeneous.
Incoherent;———; coherent.
Indefinite;———; definite.
Differentiation;———; a new being.
Sequence of events;———; other events.
Survival of the fittest;———; improvement.
Course of nature yesterday;———; course of nature to-day.
Matter;———; another form of matter.

In this table the entire system of the physical philosophy of positivism is represented. Each one of many of these is the basis and material out of which theories have been constructed. Here is the entire philosophy of evolution. They are science constructed according to the Comtean philosophy. The causal relation is wanting in all these cases. The word energizing cannot be placed in the blank between the other two members in any one of these statements. The doers are left entirely out of all these statements, and out of all such philosophy, and we have only a succession of existences. In these there is no attempt to supply doers. It is an ignoring of the demand for doers. Perhaps some men are satisfied with it. There is a desperate effort made in these days to keep people from looking beneath the surface of things, as is seen in the oft repeated sneer at metaphysics.

In another system of physical philosophy feints are made at supplying doers, but they only reach to doing; and to certain classes of doings substantive names are given, and the demand for doers is cheated by an illusion.

In this philosophy there is energizing and effects, but no energizer, no thing which energizes. The formulas which express such philosophy are:

———; doing ; effects.

——— ; momentum ; motion.
——— ; vis viva ; change.
——— ; dynamic energy; phenomena; and all of these are simply———;energizing; effects.

Men have imposed upon themselves and others by supposing that dynamic energy was something that can pass from one body to another, an endless stream flowing on and on, an endless stream of doing without any doer. There is no doing without a doer, no energizing without an energizer; and as soon as the doer ceases to energize, the doing ends.

The illusion which has made this system of philosophy to appear satisfactory to many persons results from the practice of using words in the substantive, instead of the participial form—energy, dynamic energy, kinetic energy, momentum, instead of energizing. Thus the demand for a substantive cause seemed to be satisfied. This was an illusion. Motion, energy, dynamic energy, and momentum, are not substances. Energy is a property. Dynamic energy and momentum are the energizing of some substance. Motion is an effect of energizing. These are never doers or causes. They can never be placed as the first term in the formula. Dynamic energy and momentum must be placed in the middle term; and any doctrine, or theory, or system of philosophy, which is built upon them as causes, omits the cause altogether, and has the first term of the formula blank, as in the last foregoing table. The philosophy represented by this table includes the dynamic theory of matter, all explanations of phenomena where energy and dynamic energy are represented as the doers, the dynamic theory of heat, and the undulatory theory of light. Heat is molecular motion. What moves the molecules? Molecules never move themselves. Molecules never move except as they are moved by something. Self-perpetual motion of molecules in any case or in any circum-

stances is an impossibility. The condition of perpetual motion from the force of inertia is without obstruction, and in straight lines, and no matter moves in the vicinity of other matter without being obstructed by some of the forces in that other matter.

The first term in the formula must always be a doer. Nothing but substance can do. Then the first term must always be the name of some substance. If then we arrange the formula, and place in the first term the name of something which we have supposed to be the cause, and find it to be a property, or an attribute, or a relation, we may know that we have not specified the cause. The absurdity of the following statements is seen at a glance.

Transparency; energizing; transmission of light.

Weight; energizing; breaking down of a house.

A fall; energizing; heat.

Neither transparency, weight, or a fall can energize. Yet there is just as much propriety in saying that weight breaks down a house, or that a fall produces heat, as in saying that dynamic energy does anything. Weight, falling, and the dynamic energy of a falling body, are the energizing of gravity, and one is just as much a cause as the other.

The first term must always be the name of some substance which possess the property of energy. We have reached the conclusion that material substance, matter, never possesses the property of energy. Then the first term must always be the name of some immaterial substance. Then the work of separating out and ascertaining the causes in natural phenomena is simple and easy. The one of the class of causes which energizes in the production of a certain phenomenon is the cause in that case; or if more than one energizes to produce it, they are its causes. All other things and circumstances involved in that phenomenon, even though without them it could

not be, are only conditions of its occurence. We suppose that all the doers in inorganic nature have been discovered and named. They are the only causes in inorganic nature. Then in any statement respecting any inorganic natural pheonmenon, one or more of those known doers must be the first term. All phenomena occurring in inorganic nature can be thus expressed, and the first term will in every case be one or more of the inorganic forces. Thus the philosophy of causes becomes the simplest department of the philosophy of science.

The middle term of the formula must always be energizing, or some word which is the name of some form of energizing. No motion, no change, no effect whatever, in matter can be produced without energizing. Momentum is the name given to the energizing of inertia in moving matter. Dynamic energy is the energizing of any force in or on a moving body. These words, then, are names of certain classes of energizings. If either of these words is used in the formula, it must be placed in the middle term, and it may be there placed with or without the word energizing. Momentum is not an effect of the energizing of inertia, it is the energizing of inertia. Dynamic energy is not an effect of the energizing of some force; it is the energizing of some force.

If gravity and inertia should both cease at once to energize in a falling body, all its dynamic energy would be gone.

In the third term of the formula any effect may be placed. While, according to this exposition, the first and second term—the cause and the nexus—are so simple and easily ascertained, the effects are more complicated. Without attempting any classification of effects, there are some differences which we must notice. Some effects are done, finished, and the force which produced them has ceased to energize in their production. Such are a broken

dish, a tree shattered by lightning, an exploded boiler, a hole in a ship made by a cannon ball,—any change effected by any force in the shape, size, or structure of bodies, or in their direction or distance from each other which remains permanent after the force which effected the change has ceased to operate upon the matter,—these constitute one class of effects.

Other effects are continued by the continued energizing of their cause or causes. Such is motion, all motion in material bodies—matter never continues in motion an instant after the force that is moving it ceases to energize to move it. Such are molecules, held together by the continued energizing of the chemical force. Such are masses, held together by the constant energizing of cohesion. Then there are other effects which are the conditions of the activity of other forces; such as, friction, concussion, and condensation, as conditions of the activity of heat; high temperature, as the condition of the activity of light, and so forth. When heat is made apparent by friction, etc., it is not produced; the heat that was lying latent in the matter, is made to become sensible and moving heat. When a heated body is made to become luminous, the light is not produced, but the light that did lie latent in the matter, is made to become sensible or moving light. And when one force acts upon another force, the effect may be the activity of the affected force, or its action in a particular manner. Electricity acts upon magnetism, decomposes it, and places it at right angles to the line of its own action. Magnetism does the same to electricity. Thus the effect of one is the activity of the other, and its action in a particular manner. It has always been customary to classify causes according to the nature of the effects; hence the general classification into inorganic forces, vegetable forces, animal forces, mental forces, and so forth. Mankind have already found, it is

thought, all the forces, or causes, operating in inorganic nature, and named them individually. There are ten, and no more, in the present state of science.

We here introduce a table containing all the causes, operating in inorganic nature, with some effects and the nexus:

Gravity; energizing; spheres, falling bodies, etc.

Inertia; energizing; persistent rest, perpetual motion.

Cohesion; energizing; masses, elasticity in solids.

Chemical force; energizing; molecules, compounds.

Molecular repulsion; energizing; gases, vapors.

Electricity; energizing; lightning, thunder, a shattered tree.

Magnetism; energizing; bodies moved and held.

Heat; energizing; steam power, expansion, comfort, pain.

Light; energizing; luminousness, color, conditions of vision.

Crystallizing force; energizing; crystals, crystalline forms.

We see that the word energizing as the necessary connection between the cause and its effect can be introduced in all these cases. Of course, we could place in the column of effects any effect of the cause we pleased. Opposite every one of these causes might be placed as an effect some form of motion. All rebounding motion from elasticity in solids is the effect of cohesion; and the energizing of light moves itself.

If two or more forces cooperate in producing an effect, the names of both or all should be placed in the first term.

Examples:—Gravity and inertia; energizing; orbital motion of the planets.

Heat and molecular repulsion; energizing; bursting of a cannon.

We before stated that the word energizing, and any other word which we may use which is the name of a par-

ticular form of energizing, should be placed in the second term.

Examples:—Inertia; energizing, momentum of a cannon ball; demolished house.

Gravity; energizing, dynamic energy of falling water; sawed lumber.

Much has been said about the complication of causes in the production of effects. It has been said that every effect is the product of many causes, etc. If we say as Sir Wm. Hamilton did: "Everything is a cause without which the effect could not be," of course, we have a great complication of causes. But limit the word cause to doers, energizers, as we have here and as it should be, and all these complications disappear.

Take the last of the foregoing examples. The properties of the water are not a cause of its falling. The fluidity of the water, the mobility of its molecules is a condition of its falling. If it was a solid, gravity could not make it run down hill and fall. The construction of the mill, the form of the machinery, the properties of the saw, the placing of the log, etc., are all conditions in the presence of which the energizing of gravity could effect these results. Without these the effect would not be produced, they are therefore necessary conditions, but only that which energizes to produce the effect is the cause. Nor does the energizing of the man in building the mill and placing the log connect the man with the sawed lumber as a cause. The man was the cause of the mill, and of the position of the log, but not of the lumber. He thus supplies the necessary conditions upon which gravity could effect the result.

The three terms in our formula express the entire causal relation, in all its extent and limits in every possible case. In no case is that which is expressed in the first term produced or caused. In no case is that which

is expressed by the third term a cause. Each statement expresses the complete, isolated phenomonon, with no connecting link before or after it. No finite power can produce a cause. No effect can become a cause, or produce another effect. It is not possible to place the name of any natural agent before the first term in any of the statements in the foregoing table, as its cause? What can be placed before gravity as its cause? Nothing below omnipotence can produce or create gravity. What can be placed before inertia as its cause? What can produce or create inertia? Nothing can create or add to the quantity of any of the inorganic forces. Their existence is uncaused, and, their quantity unalterable by any natural agency. Their properties and modes are uncaused and unalterable by any finite power. Nor in any case can the effect of one of them become a cause. The word energizing can never be written after the third term in any statement that can be made. Place the word energizing after any statement in any of the foregoing tables, and see if it speaks the truth. How would energizing go after sawed lumber, a demolished house, and so forth?

There are cases where the action of one force supplies the condition of the action of another force; as when gravity draws a body to the earth occasioning the action of heat. Let us state this in a formula.

Gravity; energizing; a falling body.
Heat; energizing; effects.

The word energizing cannot be placed between those two statements. A falling body does not energize. It is the energizing of gravity which moves the body downward. Bodies of matter never energize. The energizing of gravity supplies the condition of the activity of the heat which lies latent in the matter.

As I said, there are two cases where forces appear to act upon each other, electricity and magnetism. There

are two kinds of electricity, and two kinds of magnetism. When the kinds are united together, they appear to lie latent in matter, and we cannot even discover their existence. When they are separated they begin to manifest phenomena. Electricity is one of the means by which the two kinds of magnetism are separated; and magnetism is one of the means by which the two kinds of electricity are separated. These two forces, not only decompose each other, but each places the other at right angles with itself. Here, if anywhere, the effect might be supposed to be a cause. Let us state these changes in a formula:

Electricity; energizing; decomposition of magnetism.
Magnetism; energizing; effects.

These two statements cannot be connected by the word energizing. Decomposition of magnetism is not a thing that can energize. Or if we should make the third term in the first of these statements action of magnetism, instead of decomposition of magnetism, still energizing could not be placed after it—*action* of anything is not a thing that can energize. Electricity may cause the action of magnetism, but it cannot cause or produce magnetism.

A force may change static inertia into moving inertia, it may cause this change in the mode of inertia, but it cannot cause inertia. Take the following example. Heat; energizing; change from static to moving inertia. Inertia; energizing; perpetual motion.

These two statements cannot be connected by the word energizing. Change from static to moving inertia is not a substance that can energize—change energizing would be nonsense. In this case the heat does not produce the inertia. Inertia is not the effect of the heat. The effect of one force is never another force. No new force nor new portions of an already existing force, is ever produced in nature. No natural cause has ever yet produced another cause. No effect is ever a cause. There is no

such thing as a chain of causes and effects in nature. No cause can be traced to anything else on earth as its cause. No effect can ever energize to produce other effects. Every phenomenon in nature can be expressed in these three terms. There is no series of phenomena that will admit of more than these three terms—cause; energizing; effect. No natural cause can be placed before the first term. The word energizing can never be placed after the third term.

Any series of events, however long and complicated, can be expressed in separate statements containing the causal relation, and no two of those statements will be connected as one the cause of the other. It matters not how long or how complicated the series of concatenated events, the doers can be separated out, and the doings of each one expressed in a single formula—cause; energizing; effect—and in no case can any two of those statements be connected together by the word energizing. Thus, when we come to have a clear and correct idea of the causal relation, and the word cause is properly limited, all this talk about endless chains of causes and effects vanishes into nothing. All this confusion, running through the ages, and often making a chaos of philosophy, has resulted from using the word cause in so many different senses. If we will use it in the single sense here indicated, or if we use it in any other sense use also a qualifying word with it, or substitute in its place the word doer, we may avoid all this confusion.

CHAPTER XII.

APPLICATION TO ORGANIC PHENOMENA.

We have concluded (1) that matter is never an actor or doer. (2) That the inorganic forces are immaterial substances. (3) That they are indestructible and unchangeable in quantity. (4) That one of them is never transformed into another. (5) That they are not created or produced by any natural agency. (6) That each one has its own naturally uncaused modes of action, which cannot be to any great extent changed. (7) That each possesses in itself a store of energy which it can use. (8) That energy is never imparted to them, nor from them to other things. (9) That they spontaneously act when the conditions of their action are present, without being acted upon by any thing outside of themselves. (10) That the forces are the only actors and doers, and hence the only causes in inorganic natural phenomena.

These principles apply, no doubt, with little modification, to organic phenomena. We know that while resemblances run through all departments of nature, there are also differences. If I say that life is an immaterial substance, I only repeat what others have said. I am not aware that any one has before said that the inorganic forces are immaterial substance, * but many have said so of life. The appearances so plainly indicate that life is not the matter

*After this was written and my theory published in a periodical Dr. A Wilford Hall, of New York, proposed the same theory in his "Problem of Human life," and expounded and defended it in the Periodicals which he has published. See note at the end of Preface.

of the body, but an invisible, imponderable something dwelling in the body and moving it, that this is the spontaneous first thought of all mankind, in all ages of the world. Men see the tree or animal body full of life and activity; they see it again motionless, dead. The matter of the body is there apparently the same, but something appears to have been in it that is not now in it, that appears to have gone out of it. These appearances are sufficient for the common consciousness of the world to conclude that life is something else than matter. That something is intangible, imponderable, and penetrable. This is a description of immaterial substance. No evidence has been adduced which disproves this seeming, or proves that these facts are not as they appear to be. Other suppositions have been made, and attempts made to explain the phenomena of life according to them, but with very little success. I see no reason why we should discard this natural and spontaneous deduction for any less satisfactory supposition. Finding the inorganic forces to be immaterial substances, our natural conclusion respecting life is confirmed by analogy.

Our third generalization respecting the inorganic forces —that they are indestructible and unchangeable in quantity—is this true of the organic forces? The generalization, that substance is indestructible and unchangeable in quantity by any finite power, is now, since the indestructibility of matter has been experimentally demonstrated, generally admitted. Finding, as we have, that this is true also of those substances which are called the inorganic forces, we have an additional basis for this generalization, and we conclude that it is true of life of the immaterial substances called the organic forces. Do we then make vegetable and brute life immortal? There are several suppositions which may be made respecting this question. We may suppose that each vegetable and

brute life is an organic entity which retains its identity in unchanged being after it separates from the body; or we may suppose that there is a common mass or atmosphere of these organic immaterial substances surrounding the earth, or in certain localities, existing in heterogeneous mixture, like the material substances of the earth. In this case we would not suppose each one to exist in a sensitive or active state, but in such state as the dormant or latent inorganic forces are at times. Immense quantities of light, heat, electricity, and magnetism lie latent in matter, and are brought forth to activity by some change in surrounding conditions. In such a state we may suppose the vegetable and brute forces to be when separated from their bodies.

In regard to unchangeable quantity, we know that a vegetable or animal life force in any particular body does increase in quantity. It commences in the germ as minute in quantity as the matter of the germ; it increases in quantity as the body increases, until it becomes an adult being. We know that the body increases by the forces in it taking of other matter, assimilating it, and adding it to their own body. In this process the forces select certain matter that they can assimilate, or that is already assimilated. If the supposition that unattached vital forces exist in a heterogeneous mass around the earth be true, the forces in the body may select from this mass their own kind, and, adding it to themselves, increase their own quantity. This would make the process of growth alike in both the material and immetarial substances which compose the being. This may explain why certain localities are more favorable for the growth of certain vegetables and animals—there may be more of their kinds of immaterial substance in one place than in another. This may also account for the spontaneous appearance of certain vegetables in soil where no seeds of that particular

vegetable can be discovered. Even if there should be found some instances of spontaneous germination, it would not prove that life could be produced by the operation of the inorganic forces upon matter; in such cases some of these unattached vital forces might, finding molecules in a state just adapted to their use, re-attach themselves to matter.

But we might suppose that the vital forces have power to take of the inorganic immaterial substances around them, and transform them into their own kind, without violating any of the principles deduced from inorganic phenomena. This would not be the transformation of one force into another by an agency external to the forces themselves, nor one force transforming itself into another, but one force taking of others and assimilating them into its own kind; a process analogous to their assimilation of matter into their own kind of matter. Either of these suppositions will explain the growth and increase in quantity of the vital forces in any vegetable or animal body.

According to our fourth generalization the inorganic forces acting upon matter can never produce a new force, or new portions of an already existing force. None of the facts of variation brought forward by Mr. Darwin and others forbid the extension of this generalization to vital phenomena; in all these gathered facts there is not one instance of the production of a new vital force, nor the transformation by any external agency of one into another, nor the production by any external agent of new portions of an already existing force. As no facts contrary to it are found among vital phenomena, we are authorized to extend this generalization to organic phenomea; and say that no natural agency can transform an inorganic force into a vital force, nor one vital force into another.

Hence also we may extend the fifth of the foregoing generalizations—They are not produced or created by any

natural agency—to organic forces. No one thinks of looking among natural agencies for a cause or producer of gravity, or inertia, or any other one of the inorganic forces. Those who do not admit a divine Creator begin with matter and all the natural forces existing and acting in matter. But under the supposition that the inorganic forces are moving molecules, one is said to be changed into another, and that portion of that other is said to be produced, or caused to be. But we have found that the forces are not molecules in motion, and that one is never transformed into another, and that new portions of them are never produced or caused to be. Among the vital forces there are found no facts which contradict this generalization, hence we may extend it to them.

Our sixth generalization is that each one has its own naturally uncaused modes of action, which cannot be to any great extent changed. The mode of action of gravity is to draw matter together; of inertia, to hold matter at rest and move it at its present velocity. Nothing causes gravity to do this, or imparts to it this mode of doing.

Nothing causes inertia to do as it does. Nothing causes heat to do as it does. Nothing causes any one of the inorganic forces to do as it does with matter. No cause, no natural reason why they do as they do, has ever been stated by any man. Even supposing them to be moving molecules, no reason has ever been assigned for their particular mode of motion. As no natural reason can be assigned for any of the inherent characteristics of any of the material elements, so are the modes of action of the inorganic forces entirely inexplicable, and cannot be attributed to any natural agency. So likewise no natural or physical reason can be assigned for the modes of action of any organic force, nor any natural agent discovered which causes them to act according to their known modes.

We find that the modes of the inorganic forces are en-

tirely invariable. This is equally true of the organic forces by any power outside of themselves. We discover in them, what we do not find in the inorganic forces, that they have a limited power to modify their own modes of action. This comes under the general law of conditions. We thus distinguish between cause and a condition; a cause is that which energizes to produce the results, a condition is that which has some relation to the result, but does not energize to produce it. Gravity and inertia act constantly independent of conditions. But inertia has two modes, and its action is according to one or the other of these, as different conditions exist; on the condition of rest, it energizes to maintain rest; on the condition motion, it energizes to perpetuate that motion. In the presence of certain conditions, heat and light are active; in the presence of other conditions they are latent. The chemical force is often dependent upon conditions of nearness, solution, vaporization, ignious fusion, etc., for its opportunity to work. Other forces are dependent upon other conditions for opportunity to work.

Then the results of the action of the forces are often dependent upon conditions. On condition that a body is elevated from the earth, and unsupported, gravity can move it down. Gravity acted upon it just as strongly before it was raised, and after it had fallen, but in those conditions it could not move the body. If the body drawn down by gravity is iron, it is not altered in shape by the fall; if it is putty, it is flattened; if it is glass, it is broken in pieces. Thus the results are dependent upon conditions in the nature of the substance acted upon. So the vital forces are often dependent upon conditions in the nature of the substance acted upon, and for their opportunity to act, and also for the results of their action. In the absence of food, the digestive forces cannot act; in the absence of the right kinds of food, they cannot build up

a healthy body,—the results of their action may vary because of conditions in the nature of the substances digested and assimilated.

Besides all this, the vital forces seem to have the power to in a slight degree modify their own modes, to adapt themselves to changed physical conditions. If the changes in physical circumstances are not too great, they can modify their own modes so as to adapt themselves to these different circumstances, and still in a manner perform their work. If the changes are too great, they cease their work and die. This is all there is in changes said to be effected in the nature of plants and animals by their environments. External physical things never effect any changes in them, but they can, in a limited degree, change their own modes to adapt themselves to their changed environments.

The relation of the vital forces to temperature and to time are determined by their own inherent characteristics, and not by their environments. Among indigenous plants in the same latitude, one seed germinates at one temperature, and another at another. One dies at the slightest touch of frost, and another, more fragile, endures the freezing of a whole winter. One plant reaches maturity and dies in a few weeks; another, with the same environments, has a period of a few months, another a few years, another a hundred, another a thousand years. One plant bears fruit in a few weeks; another waits years before it puts forth a blossom. One animal reaches puberty in a few hours, another in a few months, another in a few years. The periodicity of the sexual desire in female brutes, and of the instinct of incubation in fowls, and the changes which mark decrepitude, have no relation to environments. These and a thousand other facts show that each plant and animal has a nature of its own which

determines its modes of action, and that its modes are not determined by its environments.

Each one is a specific thing, with a specific nature, and specific modes of action. This is true of the inorganic forces, and it is equally true of the animal and vegetable forces. The vegetable forces in all vegetables, and the animal forces in all animals, have some modes in common, and some differences. We decide that among forces it is another force when it does another kind of work. The question of classification is one of the most difficult and unsettled in science. When shall we call a thing the same, and when another thing? The answer to this question depends upon the degree of intention and extension that we employ in our classification. If we require few common properties, and allow of many differences, we may say that many things are the same. If we require many likenesses, and allow of few differences, few things are the same. If we mean by the word same, identity, there must be no difference in properties or modes or time or space,—it must not only have the same properties and modes, but must also be at the same time and occupy the same space. But that is not what men mean when they say, the same force. They mean that it is a force with the same modes, although it may be at another time, and in another place. Thus we say that the same force holds the sun and also the moon in their orbits; though in one case most of it is in the sun, and in the other case most of it is in the earth. When a force has the same modes, we say it is the same force, no matter when or where we find it; and we ascertain its modes by what it does. Hence we say it is the same force when it does the same kind of work.

But here arises another difficulty: When shall it be called the same, and when another kind of work? This depends again upon our classification. Animals have been

classified on the ground of the alimentary appetite, as carnivorous, herbivorous, graminivorous, and omnivorous, animals. The question arises, Is eating animal food and vegetable food doing the same kind of work? To this some would answer, yes, and some, no. We see thus the difficulty of establishing any dogmatic rules of classification, and why differences of opinion will continue to exist among men on this point. I have admitted that the vital forces can modify their own modes in a slight degree; but of course, I do not admit that any modification they can effect, makes them to become another force. In reference to many things there is already a common agreement among mankind. All agree that vegetables are not animals, and that brutes are not men, and that the ten inorganic forces are each a different thing. Even those who have believed them to be convertible, have regarded them as different things.

I know of no better rule than the one already given: That which does another kind of work is another force; and then we must agree when to call it the same, or another kind of work. Gravity and the chemical force both draw matter together; but the chemical force results in a change of the properties of the matter drawn together, and gravity does not; hence they do not both do the same work. Molecular repulsion and heat both push matter apart; but heat gives us the sensations of warmth and burning, and, leaving the matter which it pushes apart, passes on without it, and molecular repulsion does not these; hence they do not the same kind of work. According to this rule, I should regard all the doers in all the individuals of the same species as different portions of the same force or forces, as different portions of gravity are in different bodies. The differences in the results of their doing are explained by different physical conditions, and the slight modifications which they can themselves effect

in themselves. The self-effected variations in the modes of the forces of an animal are transmissible to their posterity.

Our seventh generalization is that each force has in itself a quantity of energy which it can use. The word quantity cannot be properly applied to a passive property of matter. But it is customary to apply terms expressive of quantity to the active property of energy. One man has much energy, another has little; in vigorous health the man has much, in sickness little. I have claimed that each vital force can increase its own quantity in growth by accretions from other forces. Decrease in sickness, in paralysis, and in old age, may be explained by supposing that the forces in these conditions of body become latent and their energy unusable; or the forces may be partially, some of it perhaps wholly, separated from the body; or the physical organs through which they act may have become less suitable for their use. All of these suppositions have their parallels in inorganic nature. It is a common occurrence for portions of the inorganic forces to become latent in matter; and a body cools by portions of the heat separating from it; and the chemical force cannot act through or upon matter in one state as well as when the matter is in another state. In death the vital forces separate entirely from the body, and the inorganic forces assume control.

In our experience the quantity of energy in us available for use seems to waste by work. As this is never the case among the inorganic forces, it is questionable whether it is the fact here. Gravity, inertia, cohesion, the chemical force, and the crystallizing force energize perpetually without any decrease. In no case does electricity or magnetism appear to decrease, except by dissipation and when the two kinds of each unite in a state of satisfied inactivity. When heat appears to decrease by work it goes into a

state of latency. No one thought of explaining the disappearance of heat in these cases in any other way, till it was thought that these facts could be used to maintain the theory of transmutation. In all cases of expansion, as when a liquid becomes a vapor, there is a great decrease in sensible heat; but that the heat is not destroyed, transmuted into something else, or diminished in quantity, is known by the fact that when the matter is restored to its former state the lost heat appears again. As far as the inorganic forces can teach by analogy; when the vital forces appear to diminish by work, they go into a state of latency. No doubt it is the body that is tired, and not the forces. In violent exercise the absorptive process in the body goes on more rapidly, and the secretive process less rapidly; this inequality continued long wonld result in the destruction of the body. At a certain stage in this process, the forces refuse longer to work, that they may have an opportunity to replenish the waste of the body. Whatever energy any force ever exerts, it is all contained within itself, for,

According to our eighth generalization, energy is never imparted to a force, nor communicated from it. This, of course, is unquestionable if we admit that energy is a property. But without this admission, we have found it to be a well established generalization. When gravity energizes to pull a body down nothing imparts to it the energy it uses. When cohesion energizes to join molecular together in masses, when the chemical force energizes to join atoms together in molecules, when the crystallizing force energizes to arrange molecules in the form of crystals, when molecular repulsion energizes to hold molecules apart in gases,—in none of these cases does anything impart to the force the energy it employs. In the cases of heat, light, electricity, and magnetism, some exertion of energy often precedes their activity, but only to

supply the conditions of their activity, never to impart to them the energy they exert. Facts show this to be equally true of the organic forces. When the forces in a vegetable seed begin their activity, nothing imparts to them their energy. Heat and moisture are conditions of their activity, but the heat does not supply their energy. If the heat imparted to the seed the energy that appears there, it could impart it to a dead seed, whose physical structure is precisely the same, as far as man can discover. The forces must be already there, then the heat supplies the condition of their activity.

This is but one of the many instances of the relation of life to temperature. During all the stages of the vegetable growth, certain conditions of temperature are necessary. One seed will germinate at a low temperature, and send up its shoot through a coating of snow; another lies dormant till a tropical temperature supervenes; thus showing that a low temperature is the condition of activity in one case, and a high temperature in the other case. When the animal begins to move, nothing imparts to him the energy which moves his body. When I arise from my chair, and leave the room, nothing outside of my body imparts to me the energy that moves my body. In no case in any department of nature does one force impart to another force the energy which it uses. All the energy which any force ever employs is inherent in that force, and there is never a transferrence of energy from one thing to another. All that one force ever does to another is to present before it, or to effect in it, the conditions of its activity, or the conditions of its activity after a certain mode.

The ninth generalization—they spontaneously act when the conditions of their action are present—follows as a necessary carollary from the foregoing.

The first of the foregoing generalizations asserts that

matter is never an actor or doer. This generalization is based upon the fact that in four-fifths of all inorganic phenomena the doing is accomplished where the matter which is supposed to be the doer is not, and hence, it is not possible that matter should be the doer; and in the other one-fifth, none of the phenomena contradict this generalization, but all favor it, and, without the others, render it probable. We now extend this generalization to vital phenomena. We have already supplied actors and doers in vital phenomena which are entirely competent to do all that we see done; hence there is no necessity for supposing that in this respect vital phenomena are any different from inorganic phenomena. Indeed, the supposition that the actors are immaterial doers, and that matter is not the actor, is far more evident to common observation here than among inorganic phenomena. Still in the common language of the world material things here are often spoken of as though they were actors and doers. Soil is said to produce, climate to effect changes, food to do, medicines to effect results, etc. It is the common custom to adapt the language of common life to appearances, without any strict conformity to even known philosophical facts and principles. The sun is said to rise, the earth and sun to attract each other, molecules and atoms to attract other molecules and atoms, the body to grow, etc. If we conform our language to facts, soil does not produce. A rich soil contains an abundance of the material which the vegetable forces use to build up rapidly and vigorously their physical bodies. The sun and earth do not attract each other, but gravity in them both and extending the whole distance between them tends to draw them together. The chemical force in atoms, and extending across the space between them, draws them together. The body does not grow, but the contained forces take of other matter and build up the body. Food does not do;

but taken into the stomach, the digestive forces act upon it, assimilate it, and use it to supply the waste of the body. Medicines are not causes, they are the conditions of the acticn of the vital forces after a certain manner. In pungent, caustic, acrid, and corrosive medicines the chemical force in them acts upon the tissues of the body, disintegrating them. The result is that the vital forces arouse themselves to expel them from the body, or to resist their action, and prevent and repair the hurt. If the action of the chemical force in them is not so great as to immediately destroy the tissue, the vital forces energize with inordinate activity to protect the body and repair the hurt. This explains the results in the administration of all stimulants. Yet it is convenient to sometimes say, the medicine does, just as we say, the sun rises. The chemical force in all corrosive poisons so destroys the tissues of the body as to render them unfit for the use of the vital forces. In the presence of the narcotic poisons the vital forces go into a state of inactivity, or separate locally, partially, or wholly from their bodies.

Thus we find it possible to explain all vital phenomena without supposing that matter has power to act and do; and we find no facts here which forbid the extension of this generalization to vital phenomena. Our tenth generalization—the forces are the only actors and doers in nature—follows necessarily on the establishment of the first,—if matter does not do, the forces are the only doers.

Here we might go into a full detail of particulars, and show the incompetence of any physical theory to explain vital phenomena, and the entire competence of the theory we advocate; but we content ourselves with a few observations. According to any physical theory it is impossible to explain why homogeneous bioplasm becomes in one case an oak and in another a cabbage. Bioplasm in all seeds is precisely the same, as far as man can discover,

and the environments are in many cases the same; why these different results? The physical theory can give no answer. Our theory answers, There is in each seed a portion of immaterial substance whose inherent modes determine and constitute the nature and form of the plant which it constructs. Why does homogeneous bioplasm or albumen become in one part of the animal body bone, in another part flesh, in another part blood vessels, and so on? For these facts the physical theory can afford no explanation. Our theory answers, There is in the bioplasm, and in the embryo, and in the adult being, a portion of immaterial substance, whose modes of action accomplish just these results.

Reproduction, heredity, and personal identity are also inexplicable by any physical theory. No magician ever deceived people by any trick of jugglery more than evolutionists have by the flourish of heredity. Of course everything is explained by the law of continuity. But there is no continuity of being, either in motion or matter, between the parent and offspring. The motions in the bioplast are not the same that they are in the parent. The motions in the embryo are not the same as those in the bioplast. The motions in the adult are not the same as those in the embryo. The matter is not the same in these successive bodies, it is in every living body a perpetual flux, old matter going and new matter coming. The molecules in the body of the child are not the molecules which composed the body of the adult parent, nor those which are in the body when the child becomes a man. Thus there is no continuity of matter—it is not the same matter acting in the parent, in the bioplast, in the child, in the adult offspring. The molecular motions going on in these several bodies have not been the same in any two of them. Yet perhaps some peculiar trait discovered in the nature of the parent does not appear in the child un-

til it has become an adult, and perhaps not in the first offspring at all, and yet does appear in the offspring of the second, or third, or fourth generation. Over all these breaks in the continuity of matter, through all these changes in the molecular arrangements of the matter composing these successive bodies, over all these breaks in the continuity of motion—the motions in the parent body ceasing to be, and other motions taking their place in the body of the infant, and those motions ceasing to be and others taking their place when the infant has become a man, and all the motions in that body ceasing to be and others taking their places through successive generations of beings,—through and over all these changes in matter and motion, certain molecules—not those which have been in any of the preceding bodies—certain molecules rise up and begin to perform such motions as other molecules did perform in other bodies, perhaps half a century ago, begin to do as those other molecules did, and because those other molecules did so, to preserve the line of heredity.

The evolutionist replies: "The trait lay dormant through all these years." What lay dormant, the trait? What is the trait? What is it made of? Is it substance, or what? The matter did not lie dormant; none of the matter in this body was in the former bodies. Motion cannot lie dormant; when motion ceases to move it ceases to be. What has the evolutionist here but matter and motion to lie dormant?

According to our theory heredity is explained by saying: Portions of the immaterial substance which fills the bodies of the parents separate off and, uniting, form a new being which begins independent action apart from the parent life. Of course it carries with it the nature and characteristics of the immaterial substance from which it parted, each of the two parts of which it is composed

possessing the peculiar characteristics of the parent from which it parted, and the two natures, more or less modified by their differences in union, appear in the nature of the offspring. According to this explanation there is a continuity of substance, immaterial substance, running through successive generations, and, in consequence of differences in circumstances and conditions, some peculiar trait may not be manifest in every individual of the series, but may appear at intervals.

Again, supposing matter and motion to be all, how can we explain our consciousness of personal identity in this ever-flowing, ever-changing stream of matter and motion? Our bodies are never entirely the same in matter and motion on any two successive days, much less on any two widely separated days; why, then, do we feel ourselves to be the same being through all these changes, all the days of our lives? It appears to me that personal identity is based in the perpetually identical and changeless immaterial substance which dwells in each of our bodies, and which constitutes ourselves; which maintains its unchanged identity while the stream of matter composing our bodies flows on in perpetual change.

CHAPTER XIII.

The Process of Knowledge.

The conditions of knowledge are said to be (1) a thing to be known and a mind knowing, and (2) that the two come in such relations to each other that the existence and properties of one shall become knowledge to the other. Assuming that these two—mind and thing—are, the difficulty arises when we undertake to get them into the necessary relation to each other. This difficulty has always been realized, and efforts have in all ages been made to solve the problem. Supposing mind to be located in the brain, how do facts respecting external things get to it? Various suppositions have been made respecting the medium which conveys the information, and respecting what is conveyed. It has been generally agreed that the nerves must be the channel through which something is conveyed. Then what is conveyed? Images of things, electrical currents, nerve currents, nerve vibrations, etc., have been supposed. It was finally agreed that images of things could not be conveyed. Then how could electricity or nerve currents, or vibrations, or anything else of the kind, give us any correct idea of external things? It was alleged that there could be no resemblance between these currents or vibrations and objective things. Then the assertion was that we do not know the objective, that we know only our sensations, or only our subjective states, our thoughts and feeling. Things outside of us

may not be anything like what we suppose them to be. There is no certainty in our knowledge of external things, knowledge of external things is not possible. All our supposed knowledge of the external world is a delusion.

Finally in answer to this, a new departure was taken, originating with Kant, in which it was stated that the somethings conveyed to the mind need not bear any resemblance to external things, in fact do not,—it is not possible for them to have any likeness to things; but on their reception by the mind, certain thoughts arise, the mind performs certain acts, not at all resembling the communications received, but like the things from which those communications came. The mind has within itself certain norms, or forms of activity, natural and spontaneous to it, and on the receipt of these communications, certain of these native forms of thought arise in the mind. The communication from the external serves as a spark to discharge the already loaded mind. The act of mind which we call knowledge is mainly determined by the nature or inherent modes of action already fixed in the mind. The mind itself thus supplies a large element in our knowledge of the objective. The vibrations of air, or the consequent vibrations of the tympanum and the auditory nerve, have no resemblance to the sound which we are said to hear, but on the reception of these vibrations, the mind performs certain acts, and to those acts we have given the name sound.

But the question still remained, how do we know that the acts of mind consequent upon the communications resemble the objects from which the communications come? Kant admitted the resemblance could not be proven. We must so think and believe, but we do not *know* that our thoughts are like the things. He had maintained as against Locke and Hume the subjective origin of many of our ideas, and that the mind has posi-

tive qualities and necessary modes of action, but he had not vindicated the validity of objective knowledge. He finally concluded that all our real knowledge is of the subjective.

From Kant two streams of thought diverged, one taking the assertion that we must think and believe that the thoughts which arise in our minds in consequence of the external world, are true representations of the real, the other taking the assertion that our only real knowledge is of the subjective. The latter stream, led by Fichte and Shelling, ran into pure idealism—we know not that there is any objective world; we live in a purely ideal world. Those who followed the former stream asserted the existence and reality of the external world, and endeavored to vindicate the reliability of our knowledge of it. They endeavored to show that the thoughts which arise in the mind on the reception of communications from external things do correspond with the objects from which the communications come. This illustration has been used: One man sends a written epistle to another man. The letters written on the paper have no likeness to the thoughts in the mind of the writer, nor to the thoughts which arise in the mind of the reader, but on the reception of those characters on the paper, the same thoughts arise in the mind of the reader that were in the mind of the writer.

This illustrates the supposed process, but it does not correspond entirely with the facts in the case. Between the two men there was an agreement and understanding as to what signs should represent certain ideas. The one used those signs, and the other man knew what ideas the writer represented by those signs, and those thoughts arose in his mind. We can hardly suppose that there is a mutual understanding between the object and mind as to what signs, what vibrations, shall represent certain facts.

But the advocate says we do know external things, we know them as they are,—everybody practically acts as though he did know them; therefore these mental acts which arise on the reception of these communications must be true likenesses of external things. The fact of knowledge every one practically admits; but this does not prove that one or another theory of perception is the true one. Admitting that this correspondence between the mental forms and the objective qualities does exist, the validity of objective knowledge may be thus established; but this can hardly silence the skeptic who may deny the correspondence, and demand proof. Other suppositions besides this may bring to their support the admitted fact of knowledge.

But it is claimed that the Creator so made the human mind that it does know the meaning of the characters on this epistle received from the object. The question is still asked, How do we know that? This explanation assumes that God created the external world, and that He so created the human mind that it does understand the meaning of the hieroglyphics which come to it in the form of nerve vibrations. His integrity and truthfulness are a guaranty to us that He does not deceive us, that the thoughts which He has caused to arise in our minds on the reception of these vibrations are true thoughts of the external world. Thus the certainty of our objective knowledge depends upon our belief in the veracity of God. This may be a sufficient basis of certainty for a devout believer in God, and in His immediate agency in creation, but how is it with those who doubt His existence, or deny His agency in creation? How is it with those who have never heard of Him? Can they have no confidence in their apparent knowledge of the external world?

Others have endeavored to meet this difficulty by de-

claring that perception is not mediate, but immediate. It is asserted that the mind spontaneously cognizes in its first activity the self and the not-self, the subjective and the objective, in a single primitive act. We do not first know ourselves, and then subsequently by any process whatever come to know the external world, bnt we know them both in a primitive single act of mind. This is called immediate perception.

This is certainly an assertion that we do know both ourselves and the external world, but I do not see that it is a very clear exposition of the process of it. I do not see that it explains how things external to our bodies become present in consciousness to be known.

With all due deference to the many great men who during the ages have grappled with this problem, it appears to me that a more radical departure from the current of philosophy than has yet been taken is necessary in order that we attain to a satisfactory solution of the process of knowledge. I cannot see how immediate perception is possible if mind is an unextended something limited to the brain. It appears to me that if we declare immediate perception, we must go further and declare that mind is extended. And why not? When the Greek philosophers said "Mind has no extension," they placed a mountain across the path of any explanation of perception. Ever since that men have been trying to find out how we can see things on the other side of the mountain. That we do see them every one believes, but how? I suppose the simple fact is there is no mountain there, and that mind is extended. The objector seems to think that he shows this supposition false by saying, "Have thought, feeling, and volition extension?" We answer, certainly not, for they are acts, and acts can have no extension. But this does not prove that the actor, the substance acting, has no extension. In our definition of substance—

that which of itself occupies space—we assumed that all substances, immaterial as well as material, occupy a certain portion of space.

Some will be alarmed by this supposition, and think that by giving mind extension we make it to be matter. Not at all. I do not know why substance that has no weight, or inertia, or impenetrability cannot be extended, as well as substances which have these properties. Does the fact of extension make it necessary that the substances have these other properties? If the Lotzean theory of matter be true, it does not deprive matter of extension, although it makes it to be spirit energizing. If an immaterial substance has no space relations, it can have no relations to that which has space relations, for to become related to that is to become related to space. An unextended substance can never act simultaneously over the surface of an extended body without being itself equally extended. I cannot labor to explain how an unextended thing can act upon, or cognize, an extended thing; for to me the proposition contains a contradiction—extension and not-extension. I see no reason why the mind may not be as extended as the body. All the facts of sensation indicate that the sensitive and cognizing mind is in every part of the body; and these facts, and not any *a priori* judgment, should determine our opinions upon this subject.

I believe that the mind is as extended as the nervous system. It is a common saying of physiologists that there is more of sensation in the ends of the fingers than in any part of the brain. There are some motions going on in the body which are disconnected from consciousness; these may not be classed among the acts of mind. All that constitutes the conscious mind is connected with the brain as its head and center; but the conscious mind extends through the nerves of sensation and the mandatory nerves, and at the outer extremities of the nerves of

sensation it comes into immediate contact with the external world. We then have the thing knowing and the thing known brought into such relations to each other that knowledge is possible—the necessary condition of knowledge is supplied.

Now, according to this view of the relation existing between mind and body, let us endeavor to discover the process of knowledge. What method shall we employ in our search? I think we will not best find it by a study of adult consciousness, nor by any process of deductive reasoning. The work of first obtaining a knowledge of the objective world is long past with us, and our memory cannot aid us in ascertaining the steps by which we obtained it. It appears to me that this is a question to be settled by observation, rather than by introspection. Let us then adopt the inductive method, leave the study of consciousness, go out in the observation of facts, and seek aid even from comparative psychology.

Here is a chicken that has been hatched by artificial means, and has never seen one of its kind. It has remained in its nest till the supply of food provided for him at that period—the yolk of the egg—is nearly gone. You take it out and place its feet upon the floor. He stands erect, but does not move his feet from where you have placed them. He maintains his erect position—he has already adjusted himself to the pull of gravity, one of his environments. Soon he looks around, looks before him, as if surveying the floor. He then takes two or three steps forward. He has seen the floor before him, he moves his foot forward in certain expectation of something upon which to place his foot. He has in his mental constitution a disposition to walk; that something which he sees before him seems to be an external adaptation to the internal disposition, and he moves his foot forward confidently upon it. It turns out to be as he expected, and

his thought cf it is verified by experience, and the floor has now become to him an item of knowledge.

He sees an insect moving on the floor before him. He looks at it, watches it carefully for a little time, and then, with a quick and sudden motion, as if expecting that it might make an effort to escape, seizes it with his bill. Now, what is implied in this? In the first place, he saw it, knew of its existence, or he would not have made motions toward it. In the second place, he cognized it as something adapted to him as food. He has in his mental constitution an appetite, a want, which causes him to desire food, and which has in its mode of action intimations of that which is adapted to the supply of that want. If it had been a mouse, or a toad, or a kitten, he would not have moved his head toward it. This implies comparison, discrimination, and judgments of form, size, and general appearance. If it happens to be a disabled house-fly, after he has taken it in his bill the odor of it meets his mind in the gustatory and olfactory nerves, and by other senses than that of sight he cognizes it as something adapted to his subjective want, and he swallows it. If it happened to be a young potato bug, he would not through the sense of sight discover its inadaptablity to his want, and perhaps he moves his head toward it, but if before he actually seizes it its odor strikes his olfactory nerves, he qnickly withdraws and shakes his head as if to get rid of it. If he does not discover its odor till he has seized it, he quickly drops it, and shakes his head in disgust.

From this example it appears that the process of obtaining a knowledge of objective things is not a difficult or complicated process. It seems not to correspond with any of the explanations which philosophers have given of the process. It is not the deduction of an existence from the discovery of properties, or from the fact of resistance,

for the chicken experiences no resistance from the fly, or the mouse, or the potato bug. It does not appear to be a perception in consciousness of the self and the not-self. It seems that the sense of sight is so adjusted and adapted to the objective that through the image of light from the external object, met by the mind in the optic nerve, the object is known as an existence, and its form, size, and general appearance are cognized, and by its odor the chicken cognized in the olfactory nerves the edible qualities of the object.

Take this chicken now and place him near a hen which is caring for some others of about the same age. This chicken hears the cluck of the hen, and immediately runs toward her. He cognizes in his sense of hearing that sound as the call of the mother hen for her young. The subjective preparation and adaptation are such that he knows the meaning of that sound, without instruction and without experience, the first time he hears it.

In a little time the hen sees a hawk flying overhead, and she screams out the sound of alarm. None of her chickens have ever heard that sound before, but they cognize it at once, and know its meaning, and run and hide under her or under some weeds near by. The subjective preparation in this case is such that cognition of the meaning of the objective is immediate and perfect.

Take another case. A duck has been hatched among chickens under a hen. She goes about with the others, eats and drinks from a dish, but has never seen water except in a small basin. Some weeks pass, during which she has felt a longing for something that she has not found, and has never seen. She roams about in search of it. She believes that it exists, she has no doubt of it, she goes forth confident in her search, expecting to find it. If she had human powers of deduction, she could from her subjective desire for it form some opinion of the

nature and form and purpose of the object of her search. There is in her mind an intellectual image, type of that object. She certainly knows what she desires to do with it; if too long a time passes before she finds it, she performs without it the motions she desires to perform in it—she goes through the motions of swimming, diving, and flapping her wings as if in water, when she is still on land. At last she meets a pond of water. She cognizes it at once as the object of her search. It corresponds with the thoughts which she had respecting it before she met it. It is the thing she was looking for. She had sufficiently definite ideas of it before she met it to enable her to cognize it at once, as soon as the image of light reflected from it met her mind in the retina of her eye. She does not hesitate in uncertainty upon the brink; she does not wait to verify her sight perception of it with her other senses; she does not stop at the edge of the water and feel of it with her foot to see if it really is what she has conceived it to be; she rushes without a pause into it, as confidently as an old sailor. The knowledge of this water does not seem to be an inference from discovered properties, nor from resistance, nor a simultaneous perception in consciousness of the self and the not-self. I do not know that she has ever thought of herself as existing, or had any self consciousness; but she thought of water to swim and bathe and play in, thought of it before she met it in reality; and, on meeting it she immediately cognized it as the thing she had been thinking about, believing in, and longing for.

One more example. A calf that is a few hours old will get upon his feet and walk. Here he is in relations to the objective world. The motions that he makes in getting upon his feet are determined by subjective mental modes born in him. A colt in first getting upon his feet does not make the same motions, nor proceed in the same

way; but the motions this calf makes are common to all of his kind. The subjective modes which direct his motions imply the existence of the ground beneath him. It is not a logical deduction from his instinct to walk, but a declaration of that instinct, a declaration of the truthfulness of which he has no doubt. It is no complicated or difficult process by which he comes to know the ground. It is not a deduction from properties or from resistance. It is simply a cognition through the sense of sight and touch of the external object which his instinct implied, anticipated, foretold. It is therefore no mystery, or surprise to himself. If he could explain his mental act at this time he would say, Of course, I knew from my instinct to walk that there was ground upon which I could walk—my instinct declared the existence of the ground. If I should say that he cognized his instinct, and cognized in his instinct the declaration of the existence of its object, I supposed I would be stating the modern theory of immediate perception, but I do not suppose that he reflects upon his instinct, and the theory seems to me incomplete till some provision be made by which this subjective declaration can be verified by actual discovery. I do not suppose that the calf has any conscious thoughts of himself, or that his instinct is to him an object of reflection, but he instinctively acts out his impulse in its relation to the external world, and as soon as he sees or touches the ground he has knowledge of it.

The calf has to exert himself to maintain his erect position. He extends his feet laterally to widen his base, and if he is liable to fall, he throws out his feet in that direction. In this he does what the philosopher would do, and the philosopher would do it as instinctively as he. He has not discovered gravity, it is not an object of knowledge to him, because none of his senses can cognize it, but he has discovered a mode of energizing upon him for which he

is mentally prepared beforehand so perfectly that he acts in reference to it as the wisest philosopher. Only an intellectual being who can deduce a doer from effects, or from energizing, can know gravity, and some will not admit that this is knowledge.

He staggers up by the side of the cow in search of something. He has not much trouble in finding it. He seems to have in his mind some already formed ideas of where it is to be found, on what part of the cow's body, and its position. If he never received food from the cow, but is fed by the hand of man, he instinctively places his head and neck in the position and shape that are necessary for obtaining food from the cow, and if it were a lamb instead of a calf, he might drop on to his knees for that purpose. Here again we see the subjective preparation for and adaptation to the objective relative.

As soon as his nose touches the teat he cognizes it at once as the object of his search. He does not then cognize it through its properties or through its resistance, but he knows it as the thing he is seeking. In order to cognize it thus, he must have had a premonition of its form and feel, a subjective anticipating conception of it. How did he know it when he touched it? How did his anticipating conception of it become knowledge? He found it where his premonition located it. When he touched it, the reality given to him in the sense of touch corresponded perfectly with his subjectively anticipating notion of it. His cognition of it is very much like our re-cognition of something which we have before seen. We have an image or notion of it preserved in our memory, and when it comes again before us we cognize it as the same thing because of its agreement with the notion of it preserved in our memory. The notion which the calf had of it was not the result of former discovery, but it was born in him, created in the

first of his kind, and transmitted to all of his posterity according to the laws of heredity.

These are but examples of the general process by which brutes obtain a knowledge of the external world. These are not isolated or extraordinary cases, but all of the external world that meets the mental being of the brute in any of his senses, meets there a mental likeness or correlative, and the object is known, or becomes knowledge, by its agreement with the already existing mental notion of it. We may say, then, that knowledge is the discovered agreement of objective things with already existing mental modes or types:

Our inductions thus far have been from facts discovered among brutes. Is the process of knowledge in man any different? The human young are not provided with so many strong instincts to direct their actions. They are more helpless, and are left more dependent upon parental care. Then the human being is lifted somewhat out of the region of instinct and left more to the guidance of reason. But in all our observations of infants we can discover no difference in the process of knowledge betwen them and brutes. Nor can we at the time that a knowledge of the external world is obtained claim any superiority or greater capability in the human young. Indeed, during the first few days or even weeks of life some brute young seem to be quite superior to the human in intellectual, as well as in physical ability. Nor are there any differences in the media through which knowledge is obtained which would suggest any difference in the mental process. The organs of sight, hearing, taste and smell are constructed after the same general type.

From our observed facts we have concluded that brutes have certain premonitions, notions, mental forms, corresponding with objective things, which prepare them for the cognition of the objective. Are there any evidences that

this is true of the human mind? We know that we have in our natures such as those which we have been observing in brutes, and some of these are manifested in infants before experience. From both our observation and the study of consciousness we are certain that our generic desires are born in us.

Then philosophers have in all ages assigned to the human mind certain inborn characteristics, native modes of action, which identify it, define it, and distinguish it from inanimate things. These have been called variously inherent modes of action, desires, propensities, propensions, inclinations, dispositions, laws of thought, sentiments, powers, faculties, etc. It is evident that these are more than power to do, they are inclinations to perform some specific acts. They all, except will, have external objects. Their objects include physical things, persons, tangible and also intangible qualities, physical and also logical relations, time, space, and spiritual beings. They all desire to act, desire to find and meet their objects. In this sense they are all desires.

We are conscious now that those of our faculties, or generic desires which have not yet met their objects do desire to do so. We know also from our consciousness that, in the absence of their objects, we do form, from the nature of the faculty itself, notions, ideas of their objects. Take an example: Man has a natural desire to worship. The real object of worship is not discoverable by our senses, but from the desire itself men form notions of its object. In the first place, men know from the faculty itself what feelings should enter into the acts of worship—reverence, fear, love, self-depreciation, submission, supplication—these have entered into the worship of all nations, under all religious systems. In the second place, men form opinions from the faculty itself respecting the physical acts which properly express the sentiment of wor-

ship. The bowed head, kneeling, and prostration, are common to all religions in all ages. In the third place, men do, from the faculty itself, form ideas, notions of the being to be worshiped. He must be a being worthy of worship; he must be great, powerful, superhuman, good, just, kind to the obedient, and severe toward the disobedient. As all men are conscious of disobedience and demerit, and as the unaided mind discovers no accepted intercessor and divine Redeemer, all religions outside of Christianity consist more of fear than of love. If the object of this faculty is not revealed to any people they fix their minds upon the greatest and most worthy object known to them, and pour out their devotions to it. But after all, the object thus fixed upon does not fill out the measure of the ideal formed from the faculty itself—they are conscious of its incompleteness and incongruities, it is not entirely satisfactory to them. The ideals formed from the faculty prepare mankind for the reception of the real God when He is brought before them in a divine revelation. The object of worship there presented to mankind agrees with the notions and ideals of Him, and perfectly satisfies this want.

Such is the nature of many of our faculties which have already met their objects that we are certain that if they had not met their objects, we would long for them, seek for them, and form ideals of them. If an infant could grow up on an island without ever meeting a human being, he would long for the object of his social sentiments,—he would roam over the hills and valleys of his island home in search of their object, he would form ideals of it from the nature of the faculties themselves, and if he should at last meet it, he would cognize it at once as the object of his search. He would cognize it because of its correspondence with his ideals of it, because of its agreement with

the inborn modes of action of these faculties, with the subjective type of being which these faculties declare.

These subjective thought-forms growing out of the modes of the faculties, which I have called ideals of external things, are sometimes called norms. I have called them ideals only because that is a more familiar and generally better understood word. The subjective forms may be called types, and the objective things antitypes. Kant so far prepared the way for what appears to me to be the correct explanation of the process of knowledge. But as he denied extension to the mind, and had it locked up in some deep recess of the brain, he could not contrive any way by which the subjective norms and their objective antitypes could be brought into the necessary relation to constitute knowledge.

It has been often said that man can know only such things as he has faculties for knowing. There may be many things and properties and relations outside of mind of which there are no types within mind; of these man can never have knowledge, nor even thoughts respecting them. They are to him as God and worship are to the brute who has no worshiping faculty. Man has in his own nature the subjective norms which prepare him to know every external thing which it is possible for him to know, or if not of that precise thing, of the class of things with which this can be associated.

I will specify some of the faculties which subjectively prepare man for the perception of the objective. Among these is form. Man has inborn in his nature a faculty which gives him ideas of form, which enables him to cognize form in things, which leads him to anticipate and look for form in things, which declares the existence of form in objective things. The infant mind anticipates a world of forms around him. If a man thinks of a thing he has never seen, or of an imaginary being, he involuntarily

gives it some form. He does not feel that he has a satisfactory conception of a thing till he has ascertained its form, and been able to construct an image of it in his mind.

He has another faculty by which he cognizes size, dimension, extension, and which enables him to form judgments of relative size. In consequence of this he is disposed to give some specific dimensions to things and persons of which he has only heard.

Another faculty enables him to cognize color, light, the various forms of light, and the diversities of color.

By another faculty he cognizes number,—it enables him to count, makes a mathematical being of him.

Another faculty, which has been by some denominated "weight," and by others "the sense of force," enables him to cognize resistance, energy, force, and enables him to form judgments of the relative strength of different manifestations of energy.

Another faculty, which has been denominated "individuality," views things as concrete individuals, without any thought of their relations,—regards each as an individual without reference to any other thing, with its boundaries in space, and, if appearances seem to so indicate, its limits in time. The relativity of knowledge is the knowledge of mature and learned philosophers, and not of infant minds in perception; and the impossibility of conceiving of a beginning is an impossibility discovered in the reflections of the philosopher, and not in the unreflective perceptions of immaturity. Things as individuals do have their boundaries in space and their limits in time, and when man conceives them in the exercise of this faculty he so conceives them, without any inquiry of the before or after. This faculty also implies, foretells, and declares the existence of substance.

It is probably in the exercise of this faculty that man's

first perceptions of the objective world are formed. Things, and not relations or properties, are first conceived. The thing is discovered before its form, size, and color are thought of. The first thought is of thing, and form; size, and color are after thoughts, especially when two or more things are discovered, and the process of discrimination through comparison commences.

The foregoing faculties connect man with the physical world, and enable him to perceive physical things. But things do exist in relations, and man himself exists in relations to other beings. For the perception and regulation of these relations man has other faculties. These faculties, like the former, imply, suggest, and foretell the objective existence of certain relations. Things may be related to each other in ways that we can not discover, of which we can form no conceptions,—we can discover only such relations as have a corresponding subjective mode in our minds.

One of these subjective modes, or faculties, is called comparison. It suggests, foretells, and enables man to conceive likeness, difference, and identity. It does not, as some have said, impose these relations upon things, but these relations really existing in external things, this faculty cognizes them, causes man to desire to discover them, leads him to anticipate them,—they are antitypes of which the types exist in the mind. This faculty, employing the faculties of form, size, and color, enables man to distinguish one thing from another.

Another faculty cognizes the dual relations—cause and effect, doer and doing, motion and mover, substance and property, and all other relations where one thing is dependent upon another for its existence.

Another faculty cognizes time, enables man to form judgments of the lapse of time, measure time into equal periods, as in music, to know the relations of before and

after, and all other time relations, and to cognize limited and measured periods of time.

Another faculty takes cognizance of space, and enables man to form judgments of direction and distance, and all other space relations, and to know limited and measured portions of space.

There are other faculties which cognize other objective relations—love of beauty, which requires things and parts of things to be so related as to constitute beauty; love of order, which requires that things be related in an orderly manner, love of music, which requires sound in musical relations, etc., but as I am not writing a psychology, only bringing examples to illustrate the process we are considering, I need not mention more.

The faculties all have within them, in their mode of action, types of which the antitypes exist in the outer world. When the outer world meets the mind in the organs of sense, the type and antitype become one in knowledge, or the result is knowledge.

I have already mentioned one other fact respecting these mental modes or faculties, viz., that each faculty declares beforehand the existence of its objective relative. Whether the object be substance, properties, or relations, the faculty itself declares before the object is met that it does exist in the objective world. This declaration is to the being in whose mind the declaration exists sufficient evidence of the existence of the object to give him a confident and undoubting belief; just as the appetite of the calf declared the existence of food before he had found it, and sent him forth in confident search of it, just as the subjective want of the duck declared the existence of water to swim in before she found it; just as the social sentiments of our supposed lone man declared the existence of other beings like him. Every man instinctively believes in and trusts these subjective declarations. The man has no doubt of

the existence of the things thus subjectively declared, unless after long search he fails to find them, and even then he does not give up belief, unless doubt coincides with his wishes. Even then, though he may intellectually doubt, he instinctively acts when off his guard according to that belief.

These subjective declarations of the existence of objective things are what have been called intuitions. An intuition is a belief arising in the mind itself,—the declarations of the inborn modes of action that some objective thing or attribute or relation exists in the objective world. Knowledge is verified intuitions, or intuitions proven by the actual discovery of their objects. The intuitions which spring from the faculties which relate man directly to the physical world are verified so early that we are not generally conscious of their existence before their objects are met, or we have no memory of their action before they were merged into knowledge. An intuition alone is a sufficient basis for belief, an intuition verified by discovery through the senses, or by some other means, becomes knowledge.

But there are intuitions whose objects cannot be discovered by the senses, (1) because the object is not within reach, (2) because the object has no attributes cognizable by the senses. Of this latter class are the intuitions of time and space. We have faculties which declare their existence,—that is, we have intuitions of them, but time and space have no form, size, color, or other properties cognizable by our senses, and no substance, hence our intuitions of them can be only partially verified. The intuition of space is partially verified by the discovery of limited and bounded portions of space. These bounded portions of space are a verified intuition—knowledge—and they are just as real existence to us as the matter that bounds them. The walls of this room are no more ob-

jectively real to me than the portion of space which they inclose. The intuition of time is partially verified by the discovery of marked and measured off periods. We know a year, a day, an hour, just as well as we do a mountain, a tree, a house. Though our intuitions of space and time as wholes cannot be verified nor their objects perfectly comprehended, yet every one knows the meaning of these words, and there are no thoughts more familiar or more easily understood, even in childhood, than thoughts of time and space.

We have other unverifiable intuitions—of right and wrong in conduct, of duty and obligation, growing out of conscience; of spirit beings, immortality, and God. Though these intuitions are not verifiable by the senses, yet all men have thoughts of their objects, and they are partially verifiable by the testimony of other intuitions, by the experience of mankind in society, and by some objective probabilities. Men do not doubt the existence of their objects till they turn away from these subjective witnesses, refuse to admit their testimony, and look for objective evidence, and refuse to consider this satisfactory, and end at last in a morass of eternal darkness. The want for food is scarcely a more imperaitive want to man than the want for a divine object of worship and trust. The fact is the subjective declarations of the faculties, the intuitions, have in all ages determined, and will in all future ages mainly determine human opinions and belief.

The unverifiable intuitions growing out of the faculties of comparison and causality are in philosophy of great importance. They are the processes and highways of nearly all philosophy. We have already mentioned the verifiable intuitions of comparison—likeness, difference, and identity—but besides these there are the intuitions of classification and unity, and unity applied to being is the law of continuity, applied to space it is infinity, and ap-

plied to time it is eternity. The philosophy of the conditioned is thought traveling in the paths marked out by the intuitions of comparison, and Sir William Hamilton says there is no other philosophy. This is why his philosophy, notwithstanding his acuteness and erudition, is so unsatisfactory—it is like a man trying to walk with only one leg. He is able to give us no satisfactory account of the causal relation, it is frittered away, and made to mean only our inability to conceive of a beginning.

We have already stated that the intuitions of causality include all dual relations, all cases where one is dependent upon another for its existence. This faculty declares that its objective relative does exist, that the relation of necessary dependence does exist among objective things, that both the dependent and that upon which it depends do exist. When, therefore, we discover only one of these thus related objects, this intuition declares the existence of the other. On the discovery of the dependent, it declares the existence of that upon which it depends, even when it cannot be discovered by any other means. Hence it is said by all philosophers who use this intuition that an effect declares the existence of a cause.

This is an intuition quite as important in philosophy as the intuition of unity; they must both go hand in hand. Both thrust us out where our senses cannot go, into the regions of the super-sensuous, into the undiscovered realms of the infinite. We must take both these intuitions as declarations of the truth, though but partially verifiable. The intuition of unity is partially verified by the discovery of universal likeness, pointing to one. The intuition of causality is partially verified by our consciousness of ourselves as causes and the effects of other causes upon us.

In confirmation of the truthfulness of our intuitions there is opportunity here for a generalization, after the manner of scientists. All our intuitions which relate us

to the physical world are found by discovery to be declarations of the truth; only those which relate us to the supersensuous are left unverified by discovery. If so many of our intuitions are proven to be declarations of the truth, we have good logical ground for the generalization that all of them are declarations of truth.

The question, What of the physical world does man know? has engaged the attention of philosophers through the ages. We have anticipated this question to some extent in the foregoing discussions. The two opinions—that mind is not extended and that man does not know substance—have gone hand in hand through the centuries. It seems presumptuous for any ordinary man to question opinions so venerable and supported by so great authority; but we know that grave mistakes have been made, and that opinions have been long entertained that have at last been found to be errors. In science opinions are valued most for their newness, in metaphysics, for their antiquity. But other opinions have changed, and I think some hoary psychological opinions must give way before there can be any satisfactory explanation of the process of knowledge. There is a tendency in the latter physiologies to locate mind in all parts of the body. Life is certainly limited only by the limits of the body, and certain physiological processes are going on in all parts, some of them connected with consciousness in the brain, and some of them without such connection. I have, in common with many physiologists, assumed that the mind occupies the whole body, and it follows of course that the mind is extended.

I now take the further step that man does know substance. In chapter third I mentioned two modes by which we arrive at the existence of substance—deducing it from properties and from doing—but this is only inferential knowledge, and, however satisfactory it may be to the individual, it is not knowledge in the sense of actual dis-

covery. I now express the opinion that man discovers material substance immediately by the sense of touch.

Formerly it was declared that we know only properties and relations. Our knowledge consisted of bundles of properties, and the relations of those bundles to each other. It was claimed that we do not know any reality underlying properties. If any such exists, it was thought to be entirely beyond the reach of our discovery, to us unknown. To this it was answered that a necessary mode of our minds compels us to place substance beneath every property; hence we know, not merely properties, but substances through their properties. But still this was only inferential knowledge.

More recently resistance is said to be that which we discover through our senses. Every thing is "dynamic" in these days. All we discover of the objective world is resistance. We do not know whether there is any thing back of resistance or not; if there is any thing, it is to us unknowable, and we cannot say whether it is matter or spirit or force, or what it is. To this it was answered, as before, that a necessary mode of our minds compels us to place behind resistance a resister,—we cannot separate resistance from thing resisting. What we know, then, is not resistance, but thing resisting. This is no doubt true, but still it is only deductive or inferential knowledge. We meet with resistance, and deduce from this a thing resisting.

Notwithstanding I have the utmost confidence in the process of deducing substance from properties, and a thing resisting from resistance, I do not believe that this is the only way we obtain a knowledge of matter. I do not believe that such a generalization as resistance is first formed in the infant mind. I do not believe that the infant mind commences its activities with deductions. Deductions and generalizations are the work of mature years. Thing is

the subject, the primary thought, and the beginning of knowledge. As we begin our instruction to our children with names of things, so nature begins her culture with things. We do not first teach our children words expressing motion or comparison, but names. Much more, we do not first teach them predicates, abstractions, deductions, generalizations, conjunctions, or any other relations. These are the last that we find them capable of comprehending. If we should undertake to reverse the order of our teaching, we would come in conflict with nature, and fail. Nature is too wise to undertake such an unreasonable course, and if she should undertake it, she too would fail.

If mental action commences with the use of the intuition of the dual relations, by deducing from properties or from resistance tangible things, the process of the knowledge of matter is the same as that by which we know invisible causes, intangible doers, and spirit beings. Why then have we any clearer knowledge of material bodies than we have of immaterial causes and spirit beings. Do we not feel that we have a more real and positive knowledge of material bodies than we have of immaterial causes? Why, if we know them by precisely the same process?

But let us return to our observations. How did the chicken know the disabled housefly which crawled on the floor before him? Did he feel resistance, and infer from that a thing resisting? How did the duck know the pond of water before she had touched it? Did she feel resistance, and infer from that a thing resisting? When the calf's nose touched the cow's teat, did he formulate in his mind the idea of resistance, and infer from that a thing resisting? Take another case, a new-born infant. After suitable preparation, he is laid quietly and comfortably to rest. He sleeps a few hours. He has not been fed. He is stirred, awakened, but he does not open his eyes. A wet-nurses nipple is made to lightly touch his lips. He

opens his mouth and perhaps turns his head from side to side, as if in search of something. He knows something has touched him; he has discovered something. He knows nothing about its properties; he has not thought whether it is round or square, white or black, hard or soft; his only idea is thing. He has not thought of resistance, or thing resisting. It has touched his lips so lightly as not to indent them. Then resistance can be conceived only as reaction against conscious muscular exertion. He has discovered, not properties or resistance, but thing. What of the thing has he discovered? Not attributes, not relations, what else is there of thing but substance? He has discovered a space-filling thing, substance, and nothing else.

Then what do we now think of in contact with the material world? If I run against a post in a dark night, what do I think of, properties? resistance?—it resists me certainly, but is that what I think of? My thought is of post, hard, solid post. What does the farmer plow, properties, resistance, thing resisting? or earth, space-filling existence, substance? What does the woodsman chop with his axe, properties, resistance? or tree, a space-filling thing, substance? What does the well-digger throw up out of the earth, properties, resistance, thing resisting? or earth, space-filling matter, substance? If a grain of sand gets into a man's eye, he does not think of properties, or resistance, or thing resisting, but he is pretty sure that there is a hard, solid "lump" there. May be that there is no space filling thing there; may be he does not know that there is any such thing as matter; may be there is only an ideal world surrounding us, may be it is only resisting centers of force; may be it is only God energizing, —that is, that it is God hurting him; but he is pretty sure that there is a hard, solid lump there, a space-filling thing, substance, and he knows it as such.

The ideal philosophers have led us quite away from our

real experience, into an imaginary world, into a state of being quite transcending the state of mortals. Let us get back onto terra firma. Mankind do know matter, know matter as hard, solid, space-filling existence—that is, substance, know its substance by actual contact, mind in contact with matter, mind in immediate contact with substance, know it first, know it better than they know any thing else, before and better even than they know themselves. Because of the certainty of our knowledge of matter, because we do constantly touch and handle and know the hard, solid substance of matter, all idealizing and spiritualizing of matter, all theories of it which make it to be any thing different from what we know it by our experience to be, are most incongruous nonsense to the common sense of mankind. I think those philosophers who really desire to vindicate the attainability of truth and the validity of our knowledge, have conceded quite too much to, and prepared the way too well for, the agnosticism of this age.

If the two new doctrines here presented—that mind is extended and fills the whole body, and that we do know substance—are true, what becomes of all the mist and mystery and uncertainty respecting our knowledge of the material world, and what becomes of all those complicated contrivances devised to explain the how of knowledge? The process of knowledge becomes plain and simple and easy, just as it must be to be within the competence of brutes and infants and children, and the material world and our knowledge of it become in philosophy, just what they are in practical life to every person, real and certain. I am not disposed to weaken or invalidate our knowledge obtained by the process of deducing doers from doings. The adult may do this, but not infants. Our knowledge of the material world is certainly obtained through a process which is easier, more direct, and more simple than

that. In science the test of a theory is its competence to explain the related phenomena. According to that test no other theory of perception yet divised can stand in the same neighborhood with this.

Through the sense of touch we know material substance first. By this sense man subsequently knows certain contingent properties of substances; such as hardness, softness, roughness, smoothness, etc. There are real facts concerning material substances, facts which are immediately perceived by mind in contact with matter.

The sense of taste is the mind residing and acting in the gustatory nerves through their whole length, especially concentrated in the tongue, palate, and fauces. If we take into the mouth a lump of sugar, we perceive its presence by the sense of touch. The mind in the sense of taste does not cognize it at all until some of it is dissolved. When it is dissolved, some of it enters into the minute cells in the organs of taste, and there comes into immediate contact with mind in the gustatory nerves, and some of its properties are there immediately cognized. The sugar is then a liquid not distinguishable by sight or touch from the saliva with which it is mingled, but taste now perceives certain of its properties. No representative of the sugar, or of any of its properties, is conveyed by any means to the brain. The mind, as the sense of taste, in the mouth perceives a property of the sugar which we have named sweet. The sweet is not a thrill, or a vibration, or any thing else in the nerve conveyed to the brain. The word is not the name of a certain act of mind which ensues after certain vibrations have reached it. It is the name of a property of the substance, a property which the mind then immediately perceives. All the properties that are known through the sense of taste are real properties of the substances placed in the mouth, and they are immediately perceived by the mind there.

The sense of smell is the mind acting in and through the nerves which terminate in the membranes of the nose. Its intensest seat is there, but it extends through the whole length of the nerves to the brain. The odors which this sense—or the mind—there perceives, are real properties of substances. Particles of some vapors are sufficiently fine to enter into the cells in those membranes, and there are in direct contact with mind in those nerves, and the mind there perceives certain of their properties. The particles of other vapors enter into these cells, but this sense perceives none of their properties, because they have no properties which correspond with the modes of action of mind in this sense, and we call them inodorous substances. Taste and smell often perceive the same properties.

In the process of seeing the immediate perception is of forms of that immaterial substance which we call light. This substance moves by its own energy away from bodies, in the outline forms of those bodies, and those forms of visible immaterial substance picture those forms on the retina of the eye, and there come in immediate contact with mind in the optic nerve. The mind there perceives the forms of light which enter the eye, perceives their forms, their color kinds if they are made up of decomposed light, and the shading, or different degrees of intensity of light in different parts of those images. These different degrees of intensity of the light in different parts of the image furnish materials by which the child learns to form judgments of form other than outlines. Convexity, concavity, irregularities in surface, distance both of different objects and of different parts of the same object, —the whole art of perspective is probably learned by experience. As far as the external object is concerned, this is a case of mediate perception. The image of the object enters the eye, and is there perceived. The immediate

perception is of forms of light. The child soon learns, by the help of the other senses, that these images represent material bodies, or such may be the adapted preparation of mind that the thought of corresponding objective physical bodies arises from the simple perception of these images. Such would seem to be the case in the examples of the chicken and the fly, and the duck and the water, mentioned in preceding pages. In the course of time the child acquires skill in forming from these images judgments of the relative size, and distance, and structural peculiarities of bodies which the immaterial images represent.

In the sense of hearing the immediate perception is of vibrations. Here is one case where what the mind perceives is vibrations. Hence this is always taken as the illustration of the vibration theory of perception. When it was thought that images of things were conveyed to the mind, the sense of sight was taken as the illustration. I do not see the propriety of taking any one sense as an illustration of a process that cannot be true of any of the others. In hearing the communication of objective information to the mind in the brain though vibrations is possible; it is not possible in any other of the senses. I prefer to explain this by the others, instead of others by this, as I see that the others cannot be explained according to the supposition which is possible here. In the other four cases the mind must act at the place of sensation; hence we conclude that it does in this case. In hearing the vibrations are perceived by the mind in the ear. The air vibrations produce vibrations in the tympanum, and the mind in the auditory nerve there perceives them.

But we soon learn by the help of the other senses to attribute these vibrations to some remote object; or such may be the subjective preparation for obtaining knowledge through this medium that the mind instinctively

understands them to be representatives of objective facts. Certain it is that the mind instinctively understands the meaning of certain vibrations of the tympanum. The young babe that has never been hurt will be frightened by the mother's cry of alarm, and by other frightful and threatening sounds. We certainly soon come to attribute these vibrations to some remote objects, first to some moving physical body, then to air as a medium, and finally to some immaterial doer in the physical body. These vibrations vary in length, altitude, frequency, order of succession, and in innumerable other characteristics which have never been named. By these qualities we learn something of the nature of remote movers, and by agreeing upon certain sounds to represent thoughts a language is formed for communication among men.

The word sound is not, like the word sweet, the name of a property of some external thing. It is a general name given to all the acts or understandings of the mind from these vibrations of the tympanum. We talk about sound coming, the vibrations come; but they are sounds only when the mind acts upon them in the tympanum of the ear.

The foregoing is the explanation which we give of the acquisition of knowledge through the senses. According to this view, sensation and perception are not so positively distinguishable as has been supposed. When mind was thought to be an unextended something somewhere in the brain, and sensations were thought to be impressions produced by external bodies, and conveyed in some unknown way to the mind in the brain, sensation was manifestly something different from the action of mind which ensued when the sensation reached it. But with the view here presented, sensation and perception are one. The mind at the outer extremity of the nerve perceives and knows. Sensation is not an impression produced upon

the body by matter. Matter never produces anything. It is true, when we press against matter we meet with resistance, but it is not the matter which resists, it is the force of cohesion holding the molecules of matter together, and perhaps in solid attachment to the earth or other great bodies, and the force of inertia that is holding matter at rest. The mind is the actor and doer, and in immediate contact with matter perceives it, its substance first, and then its properties, and then its relations.

I have thus given my opinion of the process of knowledge. It will probably be called by philosophers "vulgar realism." No matter what it is called if it is only the truth. It is not a necessary part of this treatise. The criticisms and opinions of physical philosophy expressed elsewhere are not dependent upon this. The process by which we know does not in any way affect the discussions upon other points. Yet it has a bearing upon the general philosophy of agnosticism which is associated with the current physical philosophy.

CHAPTER XIV.

Application To The Human Mind.

That the human mind is an immaterial substance has been largely the opinion of mankind. This opinion is now strengthened and confirmed by the fact that we find all the doers in nature to be immaterial substance. The opinion that the matter of the body is not the actor and doer, but that something not matter dwells in the body and moves it, and thinks, and feels, has spontaneously arisen in the minds of men from their consciousness, their experience and observation. There have always been some men who dissented from this view; but in their attempts to explain vital and mental phenomena upon the supposition that the matter of the body is the doer, they have not met with great success. Our consciousness of ourselves as doers has enabled us to understand objective doing in nature. Men have projected from their experience facts and principles which enabled them to understand how the doers in nature accomplish their work. In the primitive ages of the world men did thus, to a large extent, form their opinions of natural phenomena, and explained them as passive matter acted upon by invisible doers. We are now able to come from the field of the inorganic with facts and principles which help us to an understanding of mind.

In the first place, if matter is never a doer in organic nature where some appearances seem to indicate that it is, it certainly is not in mental phenomena, where all facts

seem to be against such a supposition. Again, if the doers in inorganic phenomena are not created or produced by any natural agency, where some appearances seem to favor such a supposition, it is quite certain that the mind is not produced or created by any natural agency, for here there are no appearances which favor such a supposition.

Our sixth generalization—each force has its own naturally uncaused modes of action—throws some light upon some questions in psychology over which there has been much contention. Nothing causes gravity to draw matter together, it does so only because that is its own inherent mode of action. Nothing causes molecular repulsion to push matter apart, it does so only because it is its nature thus to do. It is so with all the inorganic forces. There is nothing in nature outside of them, or back of them, or anterior to them, which causes them to be and do as they are and do, or determines their modes of action. We now extend this generalization to mind, and say that nothing in nature causes mind to be what it is, or to do what it does, or gives it its modes of action. We find no facts in mental phenomena which conflicts with this generalization. No cause of the modes of mind has ever been mentioned, or can be discovered. No reason can be given why mind acts as it does. Why does light act as it does? Why does heat act as it does? Why does gravity act as it does? Why does mind act as it does? One of these questions is just as unanswerable as any other one of them. To all of them precisely the same answer must be given, because it is its nature thus to act, because of its own inherent modes of action.

If modes of the human mind were products of natural causes or environments, different sets of causes, different environments would result in different modes, and some people on some portions of the earth would come to have

mental modes differing from those of other portions of the earth. The fact that all human beings now found on the earth have precisely the same mental modes, is proof that they are not caused by environments. "All human beings on earth have precisely the same mental faculties." But there are differences, and the question arises, What are faculties, or primitive mental modes? We cannot here enter into a full discussion of this question. We will only say that men have agreed to call all mental modes which are common to all human beings, human faculties. Then, of course, all human beings have precisely the same faculties. Take our position here, then, all mental modes common to all living human beings are the primitive mental modes, or faculties of man. Now look back through the history of the human race. Has any one of these mental modes been added to human nature during the historic period of the human race? Some tribes have been separated from the rest of the race one thousand, two thousand, and perhaps three or four thousand years; during that time has a mental faculty, or mental mode, been added to or taken from human nature by its environments? What the human mind now is, in reference to its mental modes, in this city, it is in every city and nation and tribe of the earth. What it now is it always has been in every nation and tribe as far back in the history of the world as we have any information. Surely this is time and space enough for environments to create a new one or destroy an old one, if they have the power. Whether the positive proofs are satisfactory or not, there are no negatives, no facts found in the history of human nature which forbid the extension of this generalization to the human mind.

Now let us get a clear understanding of these mental modes. They are the natural and necessary modes of our minds, and consequently our natural and necessary modes

of thinking. We can compare and classify them with the modes of the inorganic forces. It is a mode of action of one inorganic force to draw matter together. We name that mode of action attraction. It is a mode of action of another inorganic force to push matter apart. This mode of action we name repulsion. So it is a mode of mind to compare things; and we name that mental mode comparison. It is another mental mode to love; and we name that mental mode love, and its acts we call loving. It is another mental mode to hate; and we name that mode hate, and its acts we call hating. It is another mental mode to make deductions from premises, to deduce a cause from an effect, a substance from a property, etc.; and this mode we name causality, or the deductive faculty. All our mental processes are of certain kinds, and must be of those kinds, and can be of no other kinds. The mind can do nothing different from its modes, or outside of its modes, or that is not included in its modes, more than gravity can do something besides draw matter together, or than molecular repulsion can do something with matter other than to push it apart. These mental modes, then, determine what we must necessarily think, and how we must think. They lay down railways on which our thoughts can run, must run, and they can run no where else. They therefore mark the limits of all possible knowledge. The mind can think of nothing, perceive no thing, no property, and no relation, that has not its corresponding mode in the mind.

These mental modes are also impulses; they urge, impel, and push us out into the performance of these particular kinds of mental acts. Each one is a desire, at least so far as it desires to act, and, of course, it desires to perform that particular class of acts which are included in its nature, its mode of action. All of them, except will, have external objects, and they desire to meet and obtin

their objects. They are generic desires, desires for a class or kind of things, each its own kind, its corresponding things. Desire for property is a mental mode, a faculty, a generic disease; desire for a particular piece of property is a specific desire.

Thus the human mind, like an inorganic force is a specific thing, which has a nature of its own, with specific characteristics, with specific modes of action, which are not produced by any thing on earth, which are not dependent upon their surroundings, which are the same in the midst of all environments, and which no surrounding circumstances can to any great extent change.

To show the mental process through which these subjective modes lead us we present two examples. Take the mental mode which has been named comparison. This enables us to perceive likenesses and differences among external things; these are its objective correspondents, its objects. Moved by this as an impulse, our minds go forth instinctively comparing things, and classifying them together according to their likenesses. It urges us to continue this process, forming larger and larger classes, with less and less resemblances, till we finally reach unity, or one that includes the whole. This is a spontaneous, instinctive mental process. Why? Because it is an inherent, inborn mode of action of that immaterial substance which we call mind.

Another inherent mental mode takes cognizance of certain dual relations existing among external things; these are its objective correspondents, its objects. It is sometimes called casuality, and sometimes the deductive faculty. From accumulated facts, it deduces a principle; from data, it deduces a conclusion; from properties it deduces a substance; from effects it deduces a cause; from the seen it deduces the unseen; from the known it deduces the unknown. Why does it do this? Because this is an in-

herent mode of action of that immaterial substance which we call mind.

We now advance another step. These natural and necessary modes of mind imply things objective to the mind to which they are related,—the subjective mode implies a corresponding external object. The subjective mode of love implies external object to be loved. The subjective mode of appetite implies objective edible substances. The subjective mode of fear implies objective danger, or the existence of things that will harm the body. The subjective mode which we call hope implies the existence of external things which are desirable. The subjective mode which has been called sense of sight implies the objective existence of light, and of things to be seen. The subjective mode which has been called sense of hearing implies objective sounds. The subjective mode of comparison implies the relation of likeness and difference among external things. The subjective mode which has been called the deductive faculty implies the relation of property and substance, cause and effect, premise and conclusion, etc. in external things. Thus the subjective modes of our mind imply the existence of all the objective things, properties, and relations to which we are in any wise related, or of which we are capable of obtaining any knowledge.

These subjective implications are what have been called intuitions. The subjective mode declares the existence of its corresponding object. Most of the subjective modes meet their objects so early that their declaration of the existence of their objects is not thought of as an intuition. Only the declarations of those subjective modes whose objects are not perceptible through the senses have been treated by philosophers as intuitions; only these are of any importance in philosophy. When the bjects cannot be discovered by the senses, the realiability

ity of the subjective declarations, or intuitions, comes in question, and it is a very important question. But all the other faculties equally declare the existence of their objects; and it is well for us to notice this fact, and look upon them as so many verified intuitions.

The external objects of some of the internal modes are things; of others, properties in external things; of others, relations among external things. The objects of that subjective mode which we call love are sentient beings. The object of the subjective mode which we call form is the objective fact or property of form in things. The object of that subjective mode which has been called color is the external fact or property of color in bodies. The object of the subjective mode called comparison is the relation of likeness and difference and finally unity among objective things. The objects of the deductive faculty are the dual relations among objective things. The declarations of these last two subjective modes philosophers have always recognized as intuitions. Because their objects are not tangible things, their existence has been questioned, and the declarations of these two subjective modes have been brought forward, under the names of the intuition of unity and the intuition of cause, as proofs. But this declaration of the existence of their objects is no more positive or authoritative than the declaration of love that its objects exist, or than the declaration of subjective form and color that their objects exist.

The subjective mode declares the existence of the external object, and hence the person in whose mind the declaration is, instinctively believes in the existence of the object, even before it is discovered, and also when it cannot be sensibly discovered. When the animal is hungry, he believes in the existence of the object which will satisfy that hunger, and he goes forth confidently in search of it. So does man instinctively believe in the existence

of the external objects of all his subjective modes, whether those objects are visible or invisible, things, properties, or relations. The subjective mode is to him a positive declaration of the existence of its object. It is not in his mind a deduction; he does not reflect upon the subjective mode, and deduce from it the existence of its object, but he goes forth unreflectingly, instinctively acting according to that belief. If the infant could reflect upon his generic desires, he might deduce from them the existence of their objects, and might form some opinions from the nature of the modes, of the nature of the objects. And we can now study human nature, and see what man's generic desires, or subjective modes, are, and from them deduce the existence of their objects; and our deductions, if correctly made, will always be the truth. Our subjective modes imply and declare the existence of all objective things to which we are in any way related, and thus show all our external relations. Even those who do not admit the validity of the subjective modes as proofs of external things, still go forth in their activities acting according to them, just as though they did believe them true declarations, especially when they act instinctively, unreflectingly.

Each subjective mode is to the person himself a declaration of the existence of its object. This declaration, or spontaneous belief, is an intuition. Thus the origin and basis of intuitions, over which there has been such a world of discussion, is explained. First there is the mind; then there is the subjective mode of mind; that asserts the existence of its object; that assertion is the intuition. These intuitions are spontaneous beliefs. Whether they are reliable proofs of objective things or not, they are to us spontaneous and necessary modes of thinking.

And now, are they reliable evidences of objective reality? In a former chapter we have a list of propositions which

are absolutely true, in the nature of things, independent of the mind that think them.

These are the court of final appeal in all questions of philosophy. As far as absolute truths and our intuitions deal with the same subjects they agree. It is because of this agreement that we recognize absolute truths as such. This does not throw absolute truths back upon intuitions as a basis. We perceive that they are absolute truths by their agreement with the modes of our minds, or with our intuitions; but we at the same time perceive that they are not dependent upon those modes, or these intuitions, for their existence or their truthfulness. As an illustration, we perceive the fact of likeness and difference in physical things by the agreement of that fact with the mode of mind in comparison; but we at the same time perceive that that fact is not dependent upon this mode for its existence, but that likeness and difference do actually exist among physical things, whether we think of them or perceive them, or not. So absolute truths are not dependent upon our mental modes, but we perceive them to be absolute truths by their agreement with our mental modes. If absolute truths and our mental intuitions did not agree, we could not cognize them, thus as far as we do cognize them our intuitions agree with them. Our intuitions never declare contradictions; they never violate the law of identity; they never contradict one of the absolute truths found in our table. Thus many of our intuitions are verified by their agreement with absolute truths: and, as there are found no facts to the contrary, these form a legitimate basis for the generalization, that they are all true and reliable witnesses in all cases to which their testimony will apply.

But other facts warrant a still more satisfactory generalization. Nearly all our intuitions are verified by the sense discovery of their objects. The intuition of form is veri-

fied by the discovery of objective forms; the intuition of colors, by the discovery of objective color; the intuition of likeness and difference, by the discovery of objective likeness and difference, and so on. Thus all the intuitions which assert the existence of physical things and persons, and properties, and relations, constituting more than ninety one-hundredths of all our intuitions, are shown by actual discovery to be voices of truth. As none of the voices which are not verifiable are known to be false, this forms a very broad basis for the generalization that they are all true and reliable witnesses. When the intuition of comparison when it declares the objective existence of likeness and difference is found to be true by discovery, shall we not believe it when it declares of ultimate unity? When we have found nearly all other intuitions to be true, shall we not believe that one which declares the existence of a cause for an effect? Knowledge is nothing but the verification through the senses of those intuitions which relate to sensible things. We go forth in activity intuitively believing in the existence of the physical world, and in such a physical world as does actually exist, and through the senses the intuitions meet their objects, and become actual knowledge. Thus nearly all our intuitions are verified and shown to be true assertions of the actual and real. The few intuitions which cannot be thus verified, which relate to super-sensible things are shown to be true by the multitude of others which we know to be true.

Some intuitions which relate to physical things cannot be verified in all their entirety. When an intuition is universal, as for instance, all things have resemblances, or all changes have energizing causes, it is not possible to verify it by an actual application to all things. Such an intuition is verified by the discovery of a limited number of facts. The intuition declares the fact to be true of

all things; we learn by actual discovery that it is true of all things which are within the reach of our discovery. It is then a verified intuition, and becomes a valid proof to the whole extent of the intuition. All known facts, without exception, declare the trustworthiness of the intuition. This is the basis of a generalization; hence an intuition thus partially verified is formed into a generalization. The intuition alone declares the universal fact; then finding it to be a fact in many cases, we form upon this discovered basis the generalization that it is a universal fact. Thus the existence of the fact in the undiscoverable is proven by two witnesses, by the unverified intuition, and by the generalized universal.

The intuition alone carries with it a necessary belief in the mind of the individual,—he must so think and believe. All men have the same intuitions. When therefore a proposition which accords with a human intuition is stated, all who hear and understand it receive it and believe it because it falls in with a necessary mode of their own minds; but when they reflect and ask themselves the ground and evidence of their belief, they may not be able to find a satisfactory reason for it. The proposition has been stated, and they have believed it; but why? They may see no objective evidence that it is true. They believe, but cannot tell why they believe. The only reason is that the proposition accords with a necessary mode of mind, an intuition. Those who have repudiated intuitions as witnesses admit that we must so think, but they ask why, and demand some objective evidence that it is true. The only reason is that such is a necessary mode of mind. Those who believe that mind is the product of natural causes ought to believe that the necessary processes of mind are reliable declarations of objective things, for the product would not exist in the mind if the producer did not exist in the objective.

But it is certain, as we have before seen, that the modes of mind are no more produced by external things than is the mode of gravity. Only the already existing modes of mind enable the mind to cognize these objective things, and the objective things could not produce those modes by which alone they are cognized,—these objective things could not enter the mind to produce anything there before the door through which they enter existed. When we instinctively look for resemblances, and proceed to classify, and generalize, and judge that things unknown resemble things known, it is not because resemblances do actually exist in nature, those external resemblances could not be known but for the corresponding mode already existing in the mind. If the postulate, things have resemblances, is stated to a man, he believes it, and would believe it if he had no external evidence of it, because it agrees with a spontaneous mode of his mind, an intuition. But he goes forth in action and finds that resemblances run through all things which he can discover. From these facts he makss the generalization that all things have resemblances, and now positively asserts that there can be nothing in any world that has not some resemblances to things in this world.

The intuition of cause and effect is not so easily verified; the facts are not perceived by all our senses, as resemblances are. Causes are generally invisible. This intuition is mainly verified by our conscious act of causation, and by our resistance to things which energize upon us. But these constitute two very extensive classes of facts. They are ample verification of the intuition, and ample basis for the generalized universal that all changes have energizing causes. This postulate, as a thus verified intuition, and a generalized universal, is a sufficient ground for human belief respecting things which are beyond the reach of our discovery.

The assertion of a necessary mode of mind is to me a truth. As no natural causes can be found for the modes of any of the forces, I believe that they all had a supernatural origin,—that God created all the forces, and gave to each its modes of action. He created the human mind in its adaptation to objective nature, so that its necessary modes, and its intuitions, correspond with the facts of the physical world. He gave to the human mind such modes that its spontaneous and necessary activities would express His own thoughts; and thus the realities which are, and the principles and modes of creation, appear in human consciousness, in the necessary modes of mind. So far as truth is revealed in the modes of mind, man may intuitively discover it; but only the general principles, and existences are thus revealed.

The intuitions are the doors of admission for all acquired truth, and they are credible and reliable witnesses, as far as they go, in all philosophy, and science, and religion. No science or philosophy, no knowledge whatever, is possible without them. They are the basis of all belief; and other testimony is received only because of its agreement with them. They set up, and they pull down; and nothing can long stand among men as truth, which is at war with them. Even the revealed Word is tested and tried by them, and only such writings as are in harmony with them are preserved as canonical; and these are received by men mainly because of their agreement with the intuitions, the feelings and impulses, the needs and longings, and hopes and fears of the human mind. The intuitions are reliable expressions of the true and real. No one doubts any calculations correctly made based upon the known modes of gravity; no more is any one justified in rejecting any calculations correctly made based upon the necessary modes of mind.

A further fact which we found true of the inorganic

forces is that they are capable of beginning action without being acted upon by anything outside of themselves, that in all their activities the energy they use is contained in themselves, and never imparted to them from something else. But we also found that activities are often dependent upon conditions supplied by other agencies. Now the question arises, are these facts also true of mind? what relations have external things to the *action* of mind? In the first place, here as among the inorganic forces, objective things are never causes of the action of mind. Nothing is a cause that does not possess and exert energy. Matter never possesses and exerts energy. The mind, in the sense of touch, comes in direct contact with matter, and perceives it and such of its properties as the sense of touch is prepared to cognize. The matter does not act upon the mind, does not do anything to the mind; the mind is the only actor in this case. The matter and its properties are conditions of the action of the mind after this manner. The sense of taste immediately perceives the properties of substances in contact with it which it is adapted to perceive. Of course, the mind could not perceive these properties in the absence of the substance; the substance and its properties are necessary conditions of the mind's action, but not causes. All this is true of the action of mind in the senses of smell and sight and hearing. In none of these cases does the external object act upon the mind; in none of them is the subjective energizing a continuation in another form of any objective energizing; there is no communication of energy from the condition or through the condition to the mind. All the energy exerted by the mind in consequence of the presence of the condition is inherent in the mind. Then the acts of mind in sensation are never caused, they are never effects of external causes, they are not impressions.

If these acts of mind are not effects of external causes,

certainly no others are, for in no other cases do external objects come in contact with mind. In no case where the object which is the condition of the mind's action is absent from the mind, either in space or time, can it be a cause of the action of mind. Sitting here, I desire a book. I do not see it or hear it; nothing passes from the book to my mind; it is separated from my mind by an interval of space—nothing can do where it is not. I arise and get the book. It was not a cause of the action of my mind, nor of the action of my body,—it did not exert energy upon my mind to cause it to act. My mind starts its own action, and moves my body, using only its own inherent energy. I receive a letter informing me of the death of a friend. I make arrangements and go to the funeral. The person, the death, the letter,—none of these exert energy upon my mind, to cause it to act.

It is the same in cases of remoteness in time. Nothing that was in the past, but is not now, can be a cause of the present action of the mind. That which does not now exist cannot now exert energy upon anything. The remembrance of a past and gone existence may be the condition of the action of mind after a certain manner; but the mind in the performance of those acts uses only its own inherent energy.

Things anticipated, purposes, things hoped for, ends to be obtained,—all these have now no existence, and a thing which does not now exist cannot now energize to produce results. True, since the days of Aristotle it has been customary to call ends to be attained final causes; but this is not the sense in which we here use the word cause, and it is unfortunate for philosophy that it was ever so used. That which does not now exist cannot energize upon the mind to cause it to act.

The properties of external things are preceived by the senses, and become subjective material, present in the

mind. If those properties are the objects, or correspondences, of any particular passion, that feeling arises in their presence; if they are frightful properties, fear; if they are belligerent properties, anger, etc. It is common to say that these properties excite the passion. But these properties are not things which possess the property of energy; they cannot energize to produce effects; they are only conditions of these acts of mind.

When one person influences another, and that influence results in the passive person forming certain opinions, or having certain feelings, or performing certain acts, those opinions or feelings or acts are not caused. One mind does not in this case energize upon another mind to cause it to act, or to determine the mode of its action, it only presents certain conditions in the presence of which it acts in a certain manner. The influence is exerted by placing before the mind of the other person the conditions in the presence of which he will form certain opinions, or have certain feelings, or perform certain acts. If it be a physical object that is placed before the mind, the object has the same relation to his mind that other physical objects have in sense perception. If the influence be exerted by argument, entreaties, or authority, the process is no different, one mind does not energize upon the other mind to move it a certain way. Thus we find that mind in its activities is not an exception, but, like all the other forces, the acts of mind are never caused by agents external to itself, no energy is exerted upon it, nor imparted to it, but in all its acts and doings it uses only its own inherent energy. Whatever there is in what is called insensible influence, mind may directly act upon mind.

In reference to some of the internal workings of mind there appears to be a direct acting of mind upon mind. Whatever may be our opinions of the relation of the subjective modes, or faculties of mind, to the whole mind in

unity, we cannot explain the operations of mind without speaking of them as distinct actors. One faculty acts upon another faculty. This is so in fact, and so all writers upon psychology are compelled by the fact to explain the operations of the mind. Those faculties which are called propensions, or propensities, act upon the will; they exert energy to push the person out in the performance of certain acts; and the will acts upon the passions; and different passions antagonize each other, and strive for the mastery. This we may say is one part of mind acting upon another part of mind, as we say the hand takes hold of the foot, or we may say it is mind acting upon mind. Whatever opinions we may have upon this point, or however we may express them, we cannot describe the processes which take place in our minds without saying that one faculty acts upon another. But only a part of the faculties—the propensions and will—exert energy upon the other faculties. The intellectual faculties do not energize upon the other faculties to cause them to act. This is an important fact to be noticed and remembered, the intellectual faculties do not energize upon the other faculties. Here is a process of internal working of which we find no parallel among the inorganic forces. If a passion does energize upon the will to move it, and through it to move the person in a certain direction, here is the true causal relation,—one mode of mind may act upon another mode of mind, and cause it to act, or to determine the direction of its activity.

We now proceed to consider the bearing of the foregoing facts and principles upon the question of human freedom. We have found that the acts of mind are never caused by external agencies. Then it cannot be asserted that the acts of mind are effects of objective things and therefore man is not free. To this assertion we reply, the acts of mind are never caused by external things or influences. But this fact does not prove the freedom of the will. An

act may not be caused, and yet be a necessary act. All the sense perceptions, though not caused, are necessary acts. If the hand touches a body, we cannot will not to perceive it. If the image of a body enters the eye and strikes upon the retina, we cannot will not to see it. If a sound enters the ear, we must hear it. If a substance possessing properties perceptible by the sense of taste be placed in the mouth, we must taste it, we must perceive those properties. We all understand this in practical life, and know that if we would not see an object, we must shut our eyes, or look some other way; if we would not taste a substance, we must keep it out of our mouths; if we would not hear a sound, we must shut it away from our ears, or go away from it. Thus the acts of mind in sense perception are not caused, yet they are necessary, and here is no freedom.

Again: When certain properties enter the mind, if the man gives attention to them, he must know of their presence, and, although they are only conditions of the action of mind in a certain passion, yet that passion may necessarily arise; if the properties are frightening, fear may necessarily arise; if they are provoking, anger may necessarily arise. In the presence of the condition, the action of the mind in the corresponding passion may necessarily follow. Thus it appears that in all the receptive processes of mind, on the presentation of the condition, the mind necessarily acts; and freedom is not found here.

All the freedom man has in this department of mental activity rests in his power to control and direct his attention. If a man does not wish to see an object, he can turn and look another way; if he does wish to see it, he can turn his open eyes toward it. If he does not wish to taste a substance, he can keep it out of his mouth; if he does wish to taste it, he can put it in his mouth. If a man wishes to believe a certain doctrine, he can place be-

fore his mind the conditions of that belief; if he does not wish to believe it, he can turn his attention away from the conditions of that belief, and fix his mind upon the conditions of the opposite belief. A man's power over his attention enables him to see what he wishes to see, and to turn away from or shut his eyes to what he does not wish to see, intellectually, as well as physically. Hence mankind are responsible for their beliefs,—their beliefs are to a large extent such as they choose, and voluntarily determine. The conditions which are before the minds of men are to a very large extent such as they themselves choose, with power to choose the opposite. A man can thus occasion the activity of such of his faculties as he wishes to have active, voluntarily raise in his mind a passion, or increase its intensity, by giving attention to its conditions; or he can quench it by turning his attention to other objects, and fixing his mind upon other subjects. Thus men may, to a large extent, mold their own characters, determine their own beliefs, and award their own destinies.

Among the inworking activities of mind we find other conditions of freedom. I admitted that when certain properties enter the mind through the senses, the corresponding passion unavoidably arises into activity. But in this case we know that we have some power to check and subdue the passion, and stop that emotional activity which unavoidably arose. We have power to do this to some extent by turning away from the conditions in the presence of which it arose, and thinking of something else; but that is not what I here mean. We all know that if anger has arisen in us, if the passion is not too strong, we have power to avoid the physical acts that would naturally follow, and, by an internal mental effort, in a little time to diminish the intensity of the passion, and perhaps at last entirely subdue it. If the passion is too greatly ex-

cited, we lose this power, and are swept helplessly along by the passion, and have for the time being lost our freedom. The contrast between these two cases shows that in the former case we have freedom in the power to govern and subdue the passion.

In the case of an excited propension which desires some object, it importunes, pushes, exerts energy upon, the intellectual faculties to cause them to devise plans and means for obtaining that object. It also energizes upon the will to cause it to act to execute those plans. Here is the proper causal relation—one faculty exerts energy upon another to cause it to act. But do the intellecual faculties always obey this pushing impulse? We know that we have often felt the impulse of a desire pushing the intellectual faculties to plan and the will to execute, and yet they have refused to obey the impulse, and have acted contrary to it. But, it may be said, if they resist the impulse, they have some reason for resisting it. Yes; but that reason may not be an impulse, a mover, a cause. We must keep in our minds the distinction between a reason for action and a mover to action. A decision made in obedience to a reason for action in opposition to a motive to action, shows the power of mind to control its own acts in opposition to a cause or mover. The judgment decides that it would not be best to obey the impulse, and the man acts according to that judgment in opposition to the impulse. That judgment is not a cause or mover. The impulse exerts a causative power upon the will, the intellectual judgment does not, and to act in favor of the judgment in opposition to the mover, is an uncaused act, a free act. An intellectual conception of a remote advantage or disadvantage is not a cause, mover, motive,—it does not energize upon the will. That man can act according to such an intellectual conception in opposition to an impulse, a mover, a cause, shows that man has freedom, and that it

is not true that man must act according to the strongest motive. The confusion which has existed in regard to what constitutes a cause, or motive, has befogged the minds of men upon this point. A cause or motive is that which energizes upon the will, and nothing else is a motive. The arguments against human freedom are based upon a misconception of the causal relation. Let it be remembered that this formula—cause; energizing; effect —expresses the complete causal relation in every possible case, and men will talk a good deal less nonsense than they do now. Man can act in obedience to an intellectual judgment in opposition to all motives, or in favor of a weaker and against a stronger motive. Then man is, within certain limits, a free and accountable being.

Thus we find human freedom to rest, among the receptive processes of mind, in man's power to control and direct his attention; among the inworking processes of mind, in his power to check and subdue a passion; among the outgoing activities of mind, in his power to avoid those physical acts which would naturally follow, and in his power to act according to an intellectual judgment in opposition to an impulse, or motive, mover, cause.

There is one point more which demands our attention. We have adopted the doctrine of the indestructibility of substance. But we have also seen that this does not prove perpetual identity of being; the substance may continue to be, and yet be changed, decomposed, disintegrated, and enter into new combinations and associations, and into the structure of other beings. We have thought it probable that the vegetable and animal forces pass through some such transformations, and enter into the composition of new beings. What evidence have we that a like fate does not await men? What differences can we discover between man and brute upon which we can base an expec-

tation that man will continue in conscious identical being after death?

In answer to this question I present the following considerations. We have found all along a correspondence between the modes of the mind and the objective properties and things to which they relate,—the modes of mind correspond with their objective relations. Each mode implies the existence of its object; the intuition which arises from it declares the existence of the object. By an examination of the subjective modes we can ascertain their corresponding objects. The subjective modes of any living being adapt him to, and indicate, his objective relations. By an examination of his subjective modes we can ascertain what his objective relations are. He has in his nature all the modes which his objective relations require. He has no objective relations to which he is not adapted by his subjective modes. If he has no subjective modes which relate him to certain objective things, he has no relation to those things, and they are not for him.

Now let us look at the subjective modes of brute and man, and note their differences, and see what objective differences those subjective differences imply. The brute has no relations to anything that is not an object of some of the modes existing in his nature. He has no impulses, no desires, no thoughts, no capabilities which indicate, or relate him to, anything more than the physical and temporal. He has no thoughts of immortality, no desire for it, no hopes which reach toward it, and no capability of comprehending it. He has no thoughts of eternity, or of the infinite, or of virtue, or justice, or mercy; nor of right or wrong; nor of worship, or prayer, or trust, or faith; nor of a supreme creator and governor; nor of divine providence; nor of an unseen and beneficent object of trust; nor of a moral government involving responsibility, merit and demerit, rewards and penalties according to desert.

He has modes in his nature which reach toward all things to which he is in any wise related; he has no modes reaching toward any of these; then he has no relations to any of these.

Man has thoughts of all these. These thoughts are the spontaneous outgoings of those indwelling modes in his nature which the brute has not. He has a mode in his nature which inclines him to worship, which leads him instinctively to perform acts of worship, which gives him thoughts of a Being worthy of worship, which prostrates him before that being in adoration and supplication, in fear or confidence as he believes his own conduct to be bad or good. That mode in his nature which gives him thoughts of right and wrong, of ought and ought not, causes him to expect enjoyment from right conduct, and pain from wrong conduct. By this mode man is related to a moral government of rewards and penalties according to desert. He has a mode in his nature which gives him thoughts of endless being, which awakens in him longings for it, and which is alone a sufficient basis for a confident hope. These modes relate man to all their objects; to God, to a moral government, and to immortality and eternal life.

Thus the natural proofs of man's immortality are found in his intuitions, in the natural and necessary modes of action which exist in his mental constitution. While it is true that "Life and immortality are brought to light in the gospel," and clearly and positively only there, these inborn intuitions are sufficient to give man a belief in his own immortality, and to prepare him to welcome and embrace the teachings of Revelation, and to awaken in him expectations that he will live forever. This is the spontaneous, first belief in man, and this evidence is a sufficient basis for his belief as long as he is willing to trust in and rest upon his intuitions. When he refuses to receive this testimony, turns away from it, and looks for the

evidence in the objective, he finds everything dying, decaying, ceasing to be, and doubt and darkness overshadow him. As man is the only living being on earth of whose endless existence we have any proof, if he looks to other beings for evidence, he does not find it, and he may conclude that man dies like the beasts. Against such a conclusion the inborn intuitions of human nature utter a loud and constant and quenchless protest. These have given to all men, in all lands and ages, the spontaneous belief in their existence after death; and doubt has arisen only when these witnesses have been repudiated, and other witnesses sought. If the facts and circumstances seem to indicate that the immaterial part of brutes will exist after death only as disorganized elements, my intuitions teach me that such will not be my fate, but that I shall continue to be as a conscious, personal, organic being, in unchanged and changeless identity.

CHAPTER XV.

THE USE OF INTUITIONS IN UNDERSTANDING NATURE.

We have seen that our intuitions, or mental modes, are the subjective basis of all objective knowledge. The correspondence between these subjective modes and the objects is the condition of knowledge. The intuitions are the subjective preparation and adaptation which render knowledge possible, and they limit and define all possible knowledge. Nothing objective can be directly known that has not a corresponding subjective mode. We know not how many things, properties, and relations there may be in the universe of which we have no knowledge, concerning which we have no thoughts, and can have none, because we have no corresponding subjective modes. However many there be, they are to us forever unknowable, and we can have no thoughts respecting them. Other beings, with other subjective modes, may think of them, and perceive and know them; but to us they are as though they were not. Everything of which man has ever had thoughts, or formed any kind of conceptions, is something which has its likeness in the subjective modes, or its likeness to things which have their subjective correspondence. Even if it is an imaginary being, it is made up of those forms and properties which have their likenesses in the modes of the mind, and which are already known.

For the sake of convenience we may consider the use of the intuitions under three objective classes,—things, properties, and relations. Man has in his nature an intuition

which corresponds with the objective fact of thing, or substance; so that when mind in the sense of touch comes in contact with space filling existence, it cognizes it as something, thing, substance. Every man has such thoughts. These thoughts are among the common every day experiences of all mankind. When called upon to define what they thus discover and think of, they may not be able to state any fact respecting it which is true of it and of nothing else. All that I could think to say of it that is not true of anything else was, It of itself occupies space; hence I define substance as that which of itself occupies space. However we may define it, when the mind comes in contact with that which fills space to the exclusion of other substance, this intuition is verified, it has met its object, and the result is knowledge; hence I say that we do know substance. But so far the mind only knows that it is, that it exists in space and occupies a portion of space.

What do we know of space and time? and how do we obtain what knowledge we have? I will not attempt to define space and time, for I consider them undefinable. We can present many negative statements respecting them: They are not substance; they possess no properties by which they can be defined; they do nothing to which we can point as their work. I know of no positive fact which can be stated of them which would be true of them and of nothing else. Yet they are in every man's thoughts, and they are spoken of and talked about by every human being. All attempts to crowd them out of being, to represent them as only attributes, or as having only a subjective existence, shock common sense, and contradict all the thoughts of every man respecting them. Here they are, then, undefinable, indescribable, and yet as familiar to us as the ground on which we tread. How does man know them? Has that ever been answered? Probably some will think, after reading this, that I have not

answered it. I only need to refer the reader to our many times described process of knowledge—a subjective mode or intuition meeting its object. But our knowledge or conception of time and space is imperfect and unsatisfactory, because the object cannot be fully met,—they have no substance, properties, or modes which can enter the mind through the senses to meet the intuition, and make it to become actual knowledge. Then the mind cannot image in itself a formless and boundless thing. Still, the intuition of space is partially verified, as I have before said, by limited and bounded portions of space, and so far we have actual knowledge of it. I have knowledge, a clear and definite conception, of the portion of space inclosed by the walls of this room. This portion of space has form and size, and I can construct a clear image of it in my mind. I know that that portion of space is a real objective existence, and not a mode of thought or an attribute of anything. It is a real objective existence, just as much as the walls that inclose it. It is the same with all other limited and bounded portions of space, of which I know the form and dimensions. But I know that the walls of this room effect no break in the continuity of space; space is where the walls are, as well as this side and beyond. Thus the intuition of space, which is of unlimited space, becomes knowledge only of limited and bounded portions of it. Whatever thoughts we have of boundless space, they are the thoughts which arise from an intuition alone, thoughts which have not become knowledge by meeting their object. In this unverified field of the intuition we can examine specimens of the thoughts which arise from all the intuitions before they meet their objects. Knowledge is verified intuitions, but we have thoughts of things arising from our intuitions alone, before they are verified, and when it is not possible to verify them.

Another mental mode or intuition corresponds precisely with objective time. This intuition cannot be verified by a sense discovery of whole time. It is, like the intuition of space, partially verified by measured and marked off periods of time. We know in consciousness from the intuition alone of the lapse of time, and we are able to form judgments—more or less correct—of the length of time that has intervened; and tell whether intervals are long or short, equal or unequal, uniform or irregular. We know that measured portions of time are more and less. We know that the swing of the pendulum occupies time. We know an hour, a day, a week, a month, a year. So far objective time has become actual knowledge to us; but of unlimited time we have only intuitional thoughts, unverified by objective discovery. We know, through a process which will be hereafter described, that space and time are limitless, infinite; but only finite portions of them become real knowledge to us by verification through the senses.

There is another subjective mode which has been denominated individuality. This corresponds with the objective fact of individual things. It takes no cognizance of relations, but conceives each individual as an unrelated thing, with metes and bounds in space. By this intuition things are thought of as isolated individuals, without any reference to their relations. It is thus that physical objects are first cognized. The man has the conception of thing on his first discovery of filled space, or substance before he has discovered or thought of any of its properties or its relations. He knows nothing of it but as a thing existing in space. The thing is discovered before any of its properties or relations are discovered; the knowledge of the thing precedes a knowledge of any of its properties or relations. When its properties—form, size, color, etc.,—are discovered, his conception of the thing is not

formed by an aggregation of these properties, but these are added to the already existing conception of thing, and the conception now is of thing with this form, this size, and so forth. It is not first known by comparing it with something else, but when two things become thus individually known, they are compared together. Those philosophers who have said, "Knowledge begins with concrete things," have spoken the truth; but there is not much concretion, for all that is known at first is the bare fact of space filling existence. Those philosophers who have said that knowledge begins with properties, and those who have said that if begins with relations, have both been mistaken, I think. This intuition ever afterward conceives things as isolated individuals. By far the largest part of human conceptions is of things as isolated individuals. In common practical life things are thus thought of and spoken of a hundred or more times to every one time that their relations are thought of or spoken of. Men, animals, trees, houses, all physical things, are mainly thought of and dealt with by man in practical life as unrelated individuals. Comparisons are often instituted, but thousands, millions of times every day things are thought of when at the same time no thought of any of their relations to other things is in the mind. It is strange that so little attention has been given to this fact in philosophy, and that the philosopher's philosophic conceptions of things in their relations should be thought to be the only possible conceptions. The major part of human thoughts of things is of them as isolated individuals, limited and bounded in space.

According to this intuition man conceives things, not only limited and bounded in space, but also limited in time, with beginnings and endings, isolated from all before and after. All events beginning and ending are thought of by it without any reference to predecessors or successors. The philosophy of limitless continuity, of which we

hear so much in these days, is based entirely upon the intuition of comparison, and ignores entirely the intuition of individuality. When a man looks at a house, he notices its color, form, dimensions, etc., but he does not think of the lumber of which it was constructed, of the trees of the forest out of which the lumber was made, and so on; he looks at it and thinks of it as an individual, an event, beginning and now existing in time. Nor does he usually refer back to the owner, the builder, the architect. Nor does he usually, looking forward, think that it will by and by rot, and its carbon uniting with the oxygen of the air become an invisible gas, and so on. This is not the way that mankind usually think of houses, or anything else. Almost all the common conceptions of mankind respecting things, are of them as temporal, individual events in time, beginning to be, and ceasing to be. These conceptions are the work of an intuition in human nature. This intuition has its objective correspondences in the innumerable things which do begin and end. This intuition separates things from their predecessors and their successors, from all that went before and all that may come after, and thinks of them without thinking of their antecedents and sequents, and views things as individuals isolated in time, as well as space. In the exercise of this intuition, men have no difficulty whatever in conceiving things as beginning and ending. Such conceptions have filled the world of thought ever since man had a being. The mass of mankind are astonished when philosophers come in and tell them that it is not possible to begin and end. When philosophers, in the exclusive exercise of comparison, run wild with unity, they deny the possibility of beginnings and endings. The intuition of individuality is just as authoritative in its sphere as the intuition of comparison. They are not contradictory, but deal with different things; and it is the business of philosophical science to find out

what things begin and end, and what things are eternal.

The intuitions are equally necessary to knowledge in the department of properties. The mind can directly perceive only such properties as have corresponding modes in the mind. We may illustrate this by reference to the senses. The mind in the sense of taste perceives certain properties, and no others; of form, color, etc., the mind can take no cognizance through that sense. Through other senses the mind can cognize other properties. But we know that substances have other properties which cannot be directly cognized by any of the senses, such as malleability, ductility, elasticity, and a multitude of others. Why cannot they be directly cognized? Because the mind has no inherent modes corresponding with them. Why may other properties be immediately cognized? Because the mind has inherent modes corresponding with them.

That the subjective mode must exist in order to perception and knowledge is shown by facts in reference to the perception of the properties of sounds. The cluck of the mother hen is understood by her young the first time they hear it. They perceive at once the characteristics of that sound which distinguish it from all other sounds. Why does not the rabbit understand that call? Because he has no mental mode corresponding with it. Why does the chick understand it? Because he has a mental mode corresponding with it. The call of the mother among all species of animals is understood by their own young the first time they hear it. There is a subjective preparation which enables them to perceive the peculiar properties of these sounds, and to cognize them, and to know their meaning, the first time they hear them; that is, they have in their mental constitutions subjective modes—as we have been saying all along—which correspond with these objective sounds, which in each species spontaneously

cognizes the properties in sounds which are peculiar to the call of that species.

The human mother shrieks, and the infant cries. The young of all animals cognize instinctively, and on first hearing, the alarming and warning properties of sounds uttered by their own species, and also the properties of sounds expressive of pain, and the properties expressive of joy, and of anger, and of love. All these properties of sounds are immediately and intuitively known. The explanation of all this is that there are subjective modes which correspond with these objective properties in sounds, and when the properties enter the mind and meet the modes, those properties are immediately cognized, and their meaning known,—the object and the mode meet, and the result is knowledge.

We have already mentioned many properties of physical things which are thus cognized. All immediately discoverable physical things, all perceptible properties in physical things and in sounds, and all immediately discoverable relations among physical things are thus directly known. These constitute a vast fund of immediate or intuitive knowledge. This is the first process of knowledge, and the knowledge thus obtained may be called primary knowledge. But besides these there are some material substances and many properties which cannot be thus immediately known. The molecules of the permanent gases and vapors are so mobile that we cannot immediately discover them by the sense of touch as substances occupying space. Some of them possess properties which are directly discoverable by the senses of smell and taste. Our knowledge of those which are not thus known is obtained through indirect and mediate processes. I need not here explain the processes by which we come to know gases and vapors, and to distinguish one from another; but I do say that in all these processes the intuitions are employed, and with-

out them none of this knowledge is possible, and in all these cases the knowledge is completed by comparing and classifying them with things known immediately. Thus, by confining a portion of gas or vapor, we find that it does occupy space to the exclusion of other matter; and that it has weight, and when the moving air comes against us, we discover that it has momentum, and know thereby that it has inertia. Thus we discover in them those properties which distinguish matter, and we classify them with matter, and say we have a knowledge of them. Thus of things which cannot be immediately cognized by the senses, but which we know by other means to exist, our conceptions become knowledge by classifying them with things already immediately known.

Many properties cannot be immediately known, because they have no corresponding subjective modes. A man strikes with a hammer upon a piece of glass, and he sees it break in pieces. Thus he discovers a property of glass, and he names that property brittleness. He heats a piece of iron, and pounds it with a hammer, and finds that he can shape it without breaking it in pieces. He thus discovers a property of iron, and he names that property malleability. Now, by calling these properties he classifies them with properties which are known immediately, or by the first process of knowledge. These properties are not known by their agreement with a subjective mode, but by their likeness to things which are thus known. Such is the nature of mind that things are deemed known when they are classified with things already known. Thus the field of knowledge is greatly enlarged by adding to immediate knowledge, things known by their likeness to things immediately known.

The department of relations is the most important philosophically. It is here that diversity of opinions more extensively prevails; and this has been the arena of a

world of controversy. People generally admit that we know properties through the senses, and most admit that we know concrete things; but when things can be known only through their relations, many deny that they are known. In knowing things through their relations, a something is discovered by the ordinary process of knowledge; the mind sees in it a relation to something else, and declares that that other thing is, though it may not be otherwise discoverable. The mind declares the relation, and bridges the chasm between this discovered thing and the undiscoverable thing, and declares that that undiscoverable thing is. Some say that this declaration of the mind is a reliable and infallible guide, and others deny its validity. We will consider some of the most important of these relations.

First, the relation between property and substance. We discover a property—for example, form—through the senses. The mind declares that that property has a relation to something else which must really exist, though we cannot by any other means know it. I have claimed that the postulate, every property declares a substance, is a derivative absolute truth. Claiming that nothing but substance can exist independently in space; as a property cannot possibly exist independently in space, if a property is found in space, we know that its substance is there. But this postulate is generally regarded as only an intuition, or necessary mode of mind. Then, if it be assumed that substance is not discoverable by the senses, there is no evidence that substance is, except this declaration of the mind. Discovering a property, this necessary mode of mind declares that its substance is. Whether we believe that this declaration is an absolute truth, or a necessary mode of mind, if we deny that substance is discoverable by the senses, we must admit the truthfulness of this declaration, or else we can have no knowledge of anything

but properties, appearances, and all knowledge of things is excluded. Even if we may, as I have claimed, immediately perceive substance, it is only the bare fact of real existence, and all knowledge of varieties in substance, and of distinctions between different substances, is impossible, unless we admit the unquestionable authority of the postulate: A set of properties declares the existence of a substance, and a different set of properties declares the existence of a different substance. The chasm between property and substance is bridged by a necessary mode of mind, and if we do not admit that it is thus bridged, if we do not step confidently upon this bridge, and say that we know what is beyond; there is no real science for us to study, no real nature for us to investigate, no real objective world. I believe that the intuition which declares from a property the existence of a substance is verified by the actual discovery of substance through the sense of touch; but this is only a verification, and does not render any less necessary our reliance upon the validity of the intuition.

Comparison is another subjective mode of which great use is made in science and philosophy. Some philosophers who deny the validity of subjective modes as bases of belief, and forbid their use in science, assert, nevertheless, that the process of comparison is necessary to any objective knowledge; they say that we can never know any thing, till two things are presented to us, and we compare them together. We have concluded that we know things first as unrelated individuals, and that two things cannot be compared till they are both separately known. But we all know that our conception of a thing is very unsatisfactory till we have compared it with other things, and discovered their likenesses and differences. Why are our conceptions so much more satisfactory after this process? Can any reason be given other than that such is

the nature of mind? The fact that external things have likenesses and differences is no reason why we should have clearer and more satisfactory conceptions of them after we have discovered those likenesses. It is a natural and necessary mode of mind, by which we are enabled to perceive likenesses and differences, by which we are led to spontaneously look for them and expect them, and which renders our knowledge of things satisfactory when we have discovered them. Such is the nature of mind that we do not feel that a thing is satisfactorily known till we discover its relations to other things.

The uses which have been made of this subjective mode in philosophy are so numerous, diverse, and complicated that to describe them would be to write a history of philosophy. But, following our plan, we will only consider a few of the leading and most important uses for which it has been employed.

The subjective mode declares the existence among objective things of the relation of likeness and difference. That is its primary intuition. Through the senses we discover this relation among objective things, and the intuition is verified. We subsequently extend this relation to things unknown and undiscoverable, and say they have their likenesses and differences to each other and to things known. This relation exists, not only among physical things, but also among immaterial substances, and they have their likenesses and differences. It exists also among motions, acts, modes of doing, thoughts, opinions, mental processes and modes. The intuition is also applied to time and space; and also to the infinite and finite, and to the eternal and the temporal. We see how vast its field is, and it is not surprising that some have thought it to embrace the whole of philosophy. It is applied to a mode which remains essentially the same, with some changes, and then the likeness and difference are both within the

one. It is applied to one material substance which is thought to be always the same substance, appearing in a variety of forms, and then the likeness and difference are both within the one thing. It is also applied to one thing which never changes, but is always like itself, when it is called identity. It receives other names according to the object to which it is applied, and the use to be made of it. In descriptive science it is classification; in logic, synthesis and generalization; in metaphysics, unity.

The first use of this subjective mode, as we have already seen, is as a means of obtaining knowledge by comparing and classifying things discovered and but unperfectly conceived with things before known. The discovery of the relation of likeness between two things is the first step in classification. We all go forth instinctively comparing things, and classifying together things that are alike. The disposition to do this is an instinctive mode of our minds, and by it we obtain a clearer conception of things. So far it is a purely instinctive process. Then men do, as a policy and plan, group things together in classes for the convenience of science. A reason can be given for this: it is the inability of the mind to grasp in a comprehension a great multitude of individuals. But this does not at all explain why we can get a more satisfactory conception of an individual thing by comparing it with other things. This can be explained only by saying that such is the nature of our minds, or such is an inherent mode of mind.

We are disposed to enlarge these classes by requiring fewer resemblances, and throwing out more and more differences, and thus to group classes into larger and fewer classes, and these into still larger and fewer, until at last all things are gathered into one, which is all likeness, with no difference,—that is, unity, identity. This in philosophy, is often called the "tendency to unity." If it is a tendency it is a tendency of something; of what, if

not of the mind? It is a peculiarity of mind, a mode of mind. The primary intuition of comparison is likeness and difference. But this we see is dual, there are two: likeness is; unlikeness is. Each of these is a declaration made by a subjective mode; each is an intuition. The intuition of likeness, as far as it finds its object in external things, finds unity there—they are so far one. It declares of the existence of unity, and, followed out to its ultimate, it terminates in absolute unity, without any differences. The intuition of unlikeness declares of the existence of diversity; and, carried out alone, without regard to its counter intuition, tends to disintegration and separation, and, fixing the mind upon the dissimilarities of things, leads us to view all things as unlike, and, if carried out to its ultimate, would exclude all likeness and unity. On the other hand, the intuition of likeness directs attention to likenesses, leads the mind to these, and away from differences, to ultimate unity. Now, both of these intuitions exist in the mind, and the objects of both exist in nature, and both must be used to obtain a correct knowledge of nature; and we must ascertain by observation where likeness is, and where unlikeness.

But we see, both in our consciousness, by watching the operations of our own minds, and in the prevailing currents in the history of philosophy, that, while both intuitions exist in the mind, the intuition of likeness is far more dominant and controlling in human thought than the intuition of unlikeness. The law of diversity occupies but a small space in philosophy; while the law of unity fills volumes, and gives form to almost all science and philosophy. The mind turns instinctively away from diversity, and has a strong preference for unity. Man experiences little satisfaction in disintegration, he does really enjoy unification. This is in him a constant controlling tendency. If he discover a thing, he wants to know its likenesses to

other things; he does not care so much about its unlikenesses; he throws them out; he does not notice them, he does not wish to notice them; he designedly and instinctively turns his attention from them. Thus we see how much stronger is our love for likeness than our love for unlikeness, how much more it is a controlling and regulating principle in the mind. Now, it is this preference for likeness, this tendency of human thought toward unity, this disposition to turn away from unlikeness, to shut out of notice and out of thought diversity, it is this instinctive mode in the operation of mind, which constitutes the basis of the intuition of unity. The predominance of our love of likeness over our love for unlikeness, leads us to seek for likeness without unlikeness, for unity without diversity, and declares that this object of our desire does actually exist. The operation of these two intuitions in the mind, one so much stronger than the other, constantly leads the mind toward unity, and ultimately to pure unity without difference or diversity.

All philosophers have admitted the existence of this tendency to unity, and this intuition of unity. Even those philosophers who forbid the use of intuitions, while stoutly denying the validity of intuitions as guides, and peremptorily forbidding their use in philosophy, do themselves, nevertheless, yield an almost slavish obedience to this. Differences of opinion arise in reference to it when we come to consider how to use the intuition of unity, to what it should be applied, and what the unity is to which it points. Nothing is more prominently characteristic of modern physical philosophy than the abundant use of this intuition; but in most cases it is a misuse. It is used, not merely to classify things together, leaving out of mind admitted differences, but to obliterate differences, and run all things together over all lines of distinction. Things are not classified on the ground of resemblances, and

traced to one in their origin; but they are regarded as one in substance. Motion and force are one; all forms of energy are one; all forces are one; force and matter are one; matter and mind are one; all kinds of matter are one; all things are one; and the one physical universe includes the all. All things are one substance; hence this universal philosophy of transmutation.

Notwithstanding its abuses, the intuition of unity is of great importance in philosophy. I will present some examples of what I consider its legitimate use; first, in the formation of a generalization. Physicists make unrestricted use of generalizations, while sternly repudiating intuitions, or subjective modes as guides. Let us notice the process by which a generalization is formed. A number of things are examined and are found to be alike in some respect. These facts constitute a basis for a generalization. We conclude that all things of this class are like those which we have examined,—we extend the fact or principle which we have found true in these examined cases unlimitedly to all cases. Why do we do this? The basis of facts is limited; the generalization is unlimited. The facts themselves can give us no information beyond their own limits. Upon what does that portion of the generalization which extends beyond the limits of the basal facts rest? We believe that those undiscovered things are in this respect like the discovered things; what is the basis of this belief? That belief has no foundation but our confidence in the intuition of unity. That portion of the generalization which extends beyond the limits of the observed facts rests upon a purely mental foundation. The intuition of unity extends this likeness to all of that kind of things. Without this intuition no generalization would be or could be made,—the principle could never be extended beyond the limits of the observed facts. It seems

unreasonable to deny all reliable authority to intuitions, while placing such unlimited confidence in this.

We will now consider some special generalizations: first, our belief in what is called the uniform course of nature. The intuition of unity applies to modes, as well as to things. When it is applied to two or more things or modes, it means their likeness to each other; when applied to one mode or thing, it means its continued likeness to itself. When we have seen things move after a certain manner for a considerable length of time, we expect that they will continue to move after that manner. If the motions be in a series, or successional round of changes, we expect that that successional round will continue as it has been. On what basis does this expectation rest? We believe that the course of nature will be essentially the same next year that it has been this year; on what evidence is that belief founded? Why do we believe that winter will pass away, and spring come, and flowers bloom, and that summer with its accessories, and autumn with its burdens of freight will follow? Men will answer, Because it has uniformly so been in the past. But the past can give us no evidence of what the future is to be, unless we assume that the future will be like the past; and it is the ground of that assumption that we are inquiring after. This belief rests wholly and only upon our confidence in the intuition of unity. The intuition of unity declares that what has been for a considerable length of time in the past will continue to be the same in the future; and men go forth instinctively so thinking, in confident expectation, without a doubt or distrust, on the platform projected by this intuition, entering the unknown future. They do not often stop to ask themselves the grounds of this confidence, or why they so think; and none are more confident than those who deny the authority of intuitions. If the series has already continued long, our expectation

is more certain; a great number of facts strengthens any generalization.

The generalization which has been denominated the law of continuity demands our attention. This law asserts that the quantity of being is unchangeable. It may undergo any number of mutations in form, but the quantity remains forever the same. I understand this to be a generalization based upon observed facts. Some have endeavored to give it other foundations. Some base this law upon our inability to conceive of a beginning or ending of being. This class of philosophers base all fundamental postulates upon human impotence; and if philosophy has no better foundation than our ignorance and weakness, it is not worth our time talking and writing about it.

Others base the law of continuity upon what is supposed to be an absolute truth: "Nothing can never become something, and something can never become nothing." If this is understood to mean that nothing can never make itself to be something, so far it is based upon a derivative absolute truth. Nothing can never make any thing of itself, nor of any thing else, can never be a maker or doer; for that which has no existence cannot do; doing without being is a contradiction. That something can never make itself to become nothing, is probably true, if by thing is meant substance; for to suppose that it could annihilate itself would be contrary to a pretty well established generalization, viz.: that substance is to all finite power indestructible. But this is not the common understanding of the postulate. Men who quote it in evidence generally mean by it that no power, not even infinite power, can make something to be when nothing was before, can begin being, or create any thing without using previously existing material. In this sense the postulate is neither an absolute truth, nor a well founded generalization. It is not an absolute truth, for there is nothing in the nature of

things which thus limits Omnipotence. Creating something where there was nothing involves no contradiction, nor does it violate the law of identity, nor contradict any other absolute truth; and we cannot so fathom the nature of the Infinite as to know what He can do or not do. The only limits upon divine power which we are authorized to make is the law of contradictions—He cannot lie, or act contrary to His own nature and laws. Creating worlds when no worlds had previously existed, without using any previously existing substance out of which to make them, is not included in this limitation.

It is not a well founded generalization. We can make no generalization of what the infinite can do or not do, except from what He has done. The facts upon which our generalization must be based are these: Matter is, the worlds are; we know they could not have brought themselves into being; we have reasons for concluding that they could not have eternally been; then we conclude that He created them. Any generalization founded upon these facts must be that He can increase the quantity of being. Nor is there any reason why we must suppose that He made the worlds by transforming portions of His own substance. There is nothing whatever to forbid our believing that He created the universe, without using any previously existing substance to make it of.

The law of continuity, so far as it is an expression of truth, is a generalization, and nothing more. It is formed as all other generalizations are. The facts which constituted its base when it was first made, long before the indestructibility of matter was experimentally proven, were the phenomena which are the objects of common every day observation. Men saw matter constantly changed in form, but unchanged in quantity—soil became living vegetables, and vegetables returned to soil; substances were chemically changed to other substances, and

might be restored again, and a multitude of similar facts. From these facts men made the generalization that matter might be transmuted into a multitude of forms, and yet its quantity remain the same. The facts alone, of course, could teach nothing beyond their own limits, but the intuition of unity extended what appeared to be true in many cases to all cases, and that generalization has been in later times called the law of continuity. When this generalization was formed and became prevalent, then commenced the age of alchemy, and men ran wild in attempts to transmute valueless substances into things of value. But all these attempts failed; and the world has ever since had a broad smile on its face over these laborious and learned follies. But in this age the generalization has been revived, and proclaimed with a great flourish of authority, and those laborious and learned follies are being again repeated.

Now, after a full examination of the question, to what extent is the law of continuity true? In the first place, facts alone can settle this question; no absolute truth nor intuition settles it. Facts seem to show that substance is to all finite power indestructible, and unchangeable in quantity. Facts also show that no elementary substance, material or immaterial, can be by any finite power transformed into any other substance. The material elements may diversely combine, different elements together, and the same elements in different proportions, and thus result in the production of a great variety of compound substances. This is all there is left of the law of continuity. It is not a universal generalization, it is applicable only to substance; and as far as transmutation is concerned it is never true of substance. Facts of change are very numerous in this world; and from these facts men have often made the generalization, all things change. But it seems there are exceptions, the elementary substances

remain perpetually unchanged; and these things which are excluded from the last part of the law, are the only things included in the first part of it.

Another very extensive class of facts found in nature is included under the terms motion and change,—changes in form, structure, correlation, and position. These are all results of energizing; they are all manifestations of power. Comparison deals with these as with all other facts. It classifies them, like with like, and we conclude that all like ones, or each class, are the work of the same doer, and we name the doer in each class, and thus we have electricity, heat, gravity, and so forth. Then, urged by the intuition of unity, men contrive some way to unify these several doers. Some seek to unify them in one way, and others in another; but all seek to unify them. Some say that they are all one in that they are energy, they are only different forms of one energy. These mistake energizing for energy; and have energy an entity, when it is only a property. Others unify them under the name force; all these forces are one force, and these different forces are convertible one into another. This is found to be a false mode of unification, for they are not convertible, one of them is never transformed into another. Others say they are all one, and that one is the divine being.

These various endeavors to unify them show the strength of the intuition of unity, and how obedient men are to its impulse; none more so than those who repudiate intuitions as guides.

We have concluded that the doers in nature are a number of separate agents which cannot be substantially merged into each other, or unified. We unite the several individual doers into classes for the convenience of science, and have the inorganic forces, the vegetable forces, the animal forces, and the intellectual forces of man. But they cannot be in any manner unified, except by tracing

them all to one in their origin, and regarding them as products of the one Creator.

Whatever mode of unification we adopt, the unity we reach must contain all the power and attributes which are found in all the individuals. If we merge them all into one, that one must contain a measure of power equal to the sum of all co-existing powers in the universe, and also all the modes and qualities which are found in all the individual powers. If we find sensation, feeling, intelligence, and will among the individuals, these must exist in the aggregated one; if that one is the original, it must have contained all; for nothing can come out of a thing that is not in it. Really, then, the one that we reach as the original, by whatever process we reach it, must be all powerful and intelligent.

We mention another class of things which comparison handles in the same way: the multitude of substances. These are in thought unified in the general term substance. Then we see the efforts of men, in obedience to the intuition of unity, to unify them substantially, in Spinoza's one sole substance, and in the attempt of many scientists to show that all material substances are only different forms of one element, and in the one sole substance of Sir Wm. Thompson, and in the opinion that all material substances are but modes, or energizings of the divine substance. While these instances are evidences of the power of this intuition in human thought, I think they are all a misuse and misapplication of the intuition. The unity of all substances is to be found only in their one original, the one out of which they all came. Thus this intuition was designed to, and thus its legitimate use does, lead us, in all channels of thought, back to the One from whom all things came, the sole primary self-existent.

We must now consider for a few minutes how the intuition of unity handles time and space. We know time by

the intuition of time partially verified by limited and measured periods of time. This would limit our real knowledge of it to those limited periods. Our intuition may be of infinite time, but our real knowledge is of only finite time. But we discover that the means by which limited periods of time are measured effect no break in the continuity of time. That of which we can discover no beginning nor end, and in which we can discover no change, the intuition of unity extends beyond the limited known, to the illimitable unknown. It is pure unchanging unity, the same eternally, and it is at once recognized as an object of this intuition. We know that we can say, time is now and here. We know that any being living in any world, anywhere in the universe, can say, time is now and here. We know that any being who has lived in the past of eternity could say, time is now. We know that any being who may live in the future of eternity can say, time is now. It is the same changeless unity in all eternity and in all space, forever identical with itself. This, then, is in so far the unity after which the mind is constantly reaching. At all times, and in all places, the same, eternal indentity. We have now reached the idea of the infinite.

The intuition of unity deals the same with space. Our actual knowledge is of only limited portions of space; but as we can discover no boundaries to it, nor changes in it, the intuition of unity extends it beyond the known, to the illimitable unknown. We know that we can say, space is here. We know that any being, on any world, anywhere in the universe, in all past time, and in all future time, can say, space is here. We know that all the suns and systems of worlds are in space, and that beyond the bounds of all worlds and systems space is. It is in all eternity the same unchanged and changeless unity, forever identical with itself. Here again we find a unity which is in so far that unity after which the mind is constantly

reaching; and here again we have attained to the idea of the infinite.

Time and space are infinite, each in its own respect, like a line of infinite length. But a line of infinite length does not interfere with other lines of infinite length, nor does infinite empty space interfere with the existence of an infinite which fills space, or with one that does not occupy space. Time and space are each a pure unity in itself; but they are empty and dead unities. The intuition of unity is not content to stop in many unities, though one-line infinites. It can never stop short of the infinite, but it must be one all inclusive infinite. Even time and space themselves must be included in the infinite. That one need not be without attributes or activities, as time and space are; but it must be without differences, unlikeness, one that changes not, the same "yesterday, to-day, and forever." Attributes, activities, thought, intelligence, feeling, will, substance, personality, and power are among the things included; yet in all He must be infinite, a universal, all inclusive, infinite One. Here the intuition of unity can rest. Beyond this it finds nothing, and seeks for nothing; it folds its wings and rests; it has attained its end; it has reached its goal.

We have included time and space in the one, and yet we have represented them as eternal self-existences. The One which includes all other things as their originator, includes time and space as attributes of His own nature. But this idea that time and space are attributes of God, must not be so understood—as it sometimes has been—as to forbid their real objective existence. That which is an attribute of mind may also have an objective existence. The intuition of unity is an attribute of the human mind; but that fact only renders more certain the objective existence of unity. God has to a large extent objectified His attributes in the material universe; but they have not

therefore ceased to be attributes. So time and space are attributes of God, and yet have an eternal objective existence. I have no occasion nor disposition here to enter upon a defense of the unconditioned. Still I will say, if time and space are attributes of God, He acts according to them, acts them out, without restraint; and objective time and space exercise no governing authority over Him.

We have now traced the working of the intuition of unity from simple likeness to the infinite, all comprehending One. Unity among co-existing things means their likeness; as far as they are alike they are one. Unity in a single thing means its unchangeableness; it is always one and the same thing. Unity among co-existing modes means their likeness; as far as they are alike, they are one. Unity in a single mode is its perpetual likeness to itself; it is always identical with itself. That which is always and everywhere identical is illimitable, infinite. It is impossible by any process to unify existing things; for however completely we may classify them together, their differences still really exist, we have only placed them out of mind, not out of being. The things which compose the universe can be really unified only in their origin. The intuition urges us on to seek for, and attain to, a unity without differences, which is always and everywhere identical, and therefore infinite, and which includes all. Such a unity is found only in the true and living God, revealed to us in His word.

USE OF THE INTUITION OF CAUSALITY.

We considered the causal relation in a former chapter and found it to be always expressed by the formula, Cause; energizing; effect. Thus dismissing the multitude of other significations in which the word cause has been used, and limiting it to that which energizes to produce effects, our work here is greatly simplified.

A necessary mode of mind declares that objective things exist in the relation to each other of energizing causes and effects,—declares that this relation does exist among objective things. Whenever, therefore, one of the related objects is discovered, that the relation may be completed according to this subjective mode, the other is declared to be. The discovered thing is seen by this intuition to be a related thing, and the counter-part of the relation is declared to be. We did, in Chapter Third, conclude that the postulate, Doing declares a doer, is a derivative absolute truth; and, since we limit the word cause to doer, this is only another way of saying that every change must have a cause. Thus we have given to this postulate all the certainty of an absolute truth. But it is also an intuition, and it is as an intuition that we are now dealing with it. On the discovery of energizing, the mind declares that to be one of the factors in this relation,—declares that that is a related fact, and that its relative, or counterpart, energizer is. On the discovery of an effect, that is cognized as a related thing, one of the factors in this relation, and the mind, in order to complete this relation according to its own subjective mode, posits the other two factors of the relation, and declares that energizing and energizer are, or have been.

In practical life, in the use of this relation, the process is usually from cause to effect. We are all the time trying to accomplish some purposes. We think what steps, what processes, what energizings, will accomplish our purposes. We know ourselves as causes capable of a great variety of energizings, and we think what kinds or modes of energizing will secure the end desired, and we make use of such as we think adapted to our purpose. We make use of natural causes by supplying the conditions of their activity, or by supplying the conditions upon which their activity will accomplish certain results. Thus the relation

between the cause and the effect is perceived by the mind beforehand, and made use of in the accomplishment of our purposes. We go forth acting according to this relation as it subjectively exists in our minds, as though it did exist objectively, with the full confidence that objective things are thus related to each other.

In philosophy the process is usually from effect to cause. We see things moving, and we ask, What moves them? We see changes taking place, and we ask, What effected these changes? We see things existing, and we ask, What caused them to be? Causes are generally undiscoverable by the senses. In many cases we can know of their existence only by their doings. Still, because of this necessary mode of our minds, we must think and believe that they are. It is sometimes said that all causes are undiscoverable through the senses. This statement is too general; there are exceptions. Electricity is discoverable through three of our senses, in the same sense that material things are discoverable through their properties. We see the flash of the spark; we hear the sound that it makes; we feel it as it passes through us. Heat is sensibly discoverable. Do we not perceive the heat as sensibly as we do the stove from which it comes? and are we not as certain of its existence as we are of the existence of the stove? Light is discoverable through the sense of sight. Light is a visible cause, a visible immaterial substance. The other natural causes are known only through their doings. But when magnetism lifts a piece of iron from the table against the pull of gravity, and moves it upward to contact with another piece of iron, we are as certain that there is something there which does this as we would be if we could see it. When an iron rod hangs suspended in the coil of a hollow helix, touching nothing but air, and we take hold of the lower end of it, and pull it down, and something resists our pull, and when we let go of it,

it springs up to its place again, we are as certain that there is something which does this, holds and lifts this rod, as we would be if we could see and handle it.

But it may be said that this is only a subjective necessity,—we must so think, but is it certain that there are invisible causes in objective nature, as we suppose? Our opinion that there is a cause based on the discovery of an effect, has some objective confirmation. Our subjective decision is that every motion, change, phenomenon, has a cause. We find from an examination of facts that ten different doers are required for the explanation of natural inorganic phenomena. We subjectively decide that they all are. This subjective decision is verified by the sensible discovery of three of them. Standing at a distance and looking upon the raging chaos of motion in a burning building, we say there is a mover, cause, there. Approaching the fire, we begin to feel the warmth and then the burning; now we have sensibly discovered the invisible cause. Thus three of the ten inorganic causes are sensibly discovered.

Again, we see that things move according to a certain uniform, invariable mode, in the midst of an endless diversity of physical circumstances. That mode must be a mode of something, a property of something. It cannot be a property of the diverse physical circumstances; it is a property of something. No property without a substance. Then by the relation of property to substance, which no one can deny without denying our knowledge of matter, we know that there is something there of which this mode is a property. Again, the changes which we see going on in nature are doings, and the law of contradictions declares that there must be existence in the doer, that these doers must exist. That which is not cannot do.

But the most satisfactory verification of this intuition is our own experience. We know ourselves as causes of

objective motions and changes. We know what we do when we effect these motions and changes. We look upon these motions and changes which we produce as effects. We look out in nature and see other motions and changes that we do not produce; they, like the motions and changes which we produce, are effects; and we very naturally conclude that something produces them, just as we produce like effects. Then things come against us, and do to us as we do to other things when we move them. Thus we know that there are in the objective, things which energize upon us, which energize, which possess the property of energy. We have ascertained that matter does not energize, does not possess the property of energy. We know that all doers must be substance. Nothing but substance can possess the property of energy, or any other property. Thus our belief in the existence of invisible doers in objective nature does not rest wholly upon the intuition of cause, but that intuition is amply verified and confirmed by other testimony.

If we do not rely upon this verified intuition, we can know nothing of energizing, or dynamic energy, in objective nature. How do men know that there is any such thing as dynamic energy in objective nature? We see bodies moving; we see one body moving against another body, and see that begin to move; but that there is any energizing, or dynamic energy involved in the phenomenon, we can never know through our senses. Scientists talk as though the fact of dynamic energy in natural phenomena admitted of no doubt; yet they know absolutely nothing of it, and can never know anything of it through the senses. They see motions and changes; these are effects; and from these they declare the existence of dynamic energy; that is, from effects they declare a cause. Here they use the intuition of causality with the most unlimited confidence, and have not the least doubt of the

existence of that which it declares to be. Those who place such unquestioning confidence in this intuition, when it declares the existence of dynamic energy, certainly cannot doubt its testimony when it declares the existence of invisible doers.

Many seem to think that when they have reached dynamic energy, they have reached a cause. We have seen that dynamic energy is only the energizing of some cause; they have reached only energizing. No one would have been at all satisfied with the current dynamic philosophy but for the illusion—not to say deception—of treating energizing as a doer, substance, cause. The same voice which declares the existence of energizing—dynamic energy—declares the existence of the energizer. If we believe the voice when it tells of energizing, we must believe it when it tells of the energizer. Thus by this intuition we are made acquainted with invisible doers in nature. We think it is not merely one doer, because there are several uniform modes of doing,—the modes run uniformly on certain lines, but there are several lines. We say of matter, another set of properties indicates another substance. So we say, another set of doings indicates another doer. Then some of these doers exist only within the limits of their bodies; while others extend indefinitely beyond. Some are perceptible through the senses; and others are not. These differences indicate different things. Thus men have concluded that there are at least ten doers operating in inorganic nature.

But the use of this intuition is not limited to the discovery of invisible causes in nature. A law indicates the existence of a law-maker. Government indicates the existence of a governor. A plan indicates the existence of a planner. Design indicates the existence of a designer. Intelligent action indicates the existence of an intelligent actor. Looking at either of these, we see that its nature

implies the existence of its cause. These are not merely linguistic relations; but language has been thus constructed in accordance with this necessary mode of mind, and thus conformed to facts. Words are expressions of thoughts; and words are related as thoughts are related; and thoughts are related as things are related. The real objective corresponds with the intuitive subjective. The objective fact of likeness and difference corresponds precisely with the subjective mode of comparison. So the objective relation of cause and effect corresponds precisely with the subjective mode which cognizes it.

There are many other applications of this intuition. When we look upon anything, and see that it is a constructed thing, see that its parts are related to each other according to some thought, or according to some plan, or as if designed to secure some end, which plan we can read in its structure, and which end is suggested to us by its formation, we say it is a made thing, and had a maker. When we look upon anything and see that it is a dependent thing; we say there is something upon which it depends. Now, everything which is finite and limited is a dependent thing; it is related to other finite things, and is more or less affected by them, and dependent upon them—I do not say for its existence, but for what it is and does. It may have existence entirely independent of other finite things; it may have properties and modes of its own entirely independent of other finite things; and yet finite things condition it, and more or less shape its being and doing. The dependence of finite things upon each other, the relations which exist among finite things, show that the universe is a made thing; and the perfect and universal adaptation of thing to thing throughout the universe, shows it all to be the work of one maker.

In the foregoing paragraph we have given some reasons why, in viewing the universe, we look upon it as an effect.

But we need not present any such reasons. In the natural and spontaneous action of the human mind, this intuition looks upon every finite thing as an effect, and asks for its cause, or posits before it a cause. We need to know no other fact about a thing but that it is finite, and this intuition asserts that it had a cause. If we can see its boundaries, or if we know that it has limits, our minds spontaneously judge it to be an effect, and look for its cause. Or if we have any reason whatever for thinking that it began to be, we posit its cause before it. Go back, back, from one stage of being to another, no matter through how many aeons of duration, if we come to a beginning of being, we declare its cause before it,—something brought it into being. It is only when we reach the illimitable and infinite that the mind ceases to demand a cause. In the self-existent and eternal it rests satisfied; as an intuition it has reached its ultimate. It has no disposition to go any farther, or to ask anything more; it instinctively stops. When we reason about it, we see how vain would be its inquiry if it was disposed to go further. What can be before the eternal to cause it to be? What can be outside of the illimitable to cause it to be? There is no before eternity, nor outside of the illimitable.

We see the universe made up of two classes of substances, the material and the immaterial. Each class is made up of several. The individuals of one kind are passive and handled. The individuals of the other class are active doers. These doers are dependent and finite things. Then the intuition of causality declares them to be effects, created things. The intuition of unity, handling these several doers, unifies them, not by running one into another, but by tracing them to the One that caused them to be. Causality declares that they had a cause, and unity unifies them in their cause. Thus both these

intuitions declare the existence of the one who created the agents operating in nature.

The material substances are also dependent and finite things. Hence the intuition of causality declares them to be created things, effects, and places before them their cause. They are several. The intuition of unity unifies them, not by the process of conversion nor transmutation, but by tracing them all to the One out of whom they came. Both of these classes of things are substance. Have we not generalized that substance is unchangeable in quality? Yes; by any finite power; but we cannot thus limit the power of the Infinite. When we go back to the bounds of the finite, we step off, not into the "unknown," but into the Infinite. The intuition of unity gathers all things into one at the last, and obliterates all differences and distinctions in the one Infinite. Then going back through all the changes of worlds and systems of worlds till we reach the formless chaos of matter, and stand, amid darkness and silence, on the periphery of the substance of unborn worlds, because even this is finite, the intuition of causality demands for this a cause, and declares that God brought it into being.

In concluding this chapter, we say that, notwithstanding scientists deny the validity of intuitions, and forbid their use in science, without them there can be no real science or philosophy. Without them no philosophy but idealism is possible, and, and we must conclude that we know nothing of objective nature, not even that there is any objective nature to study. But scientists do constantly use them themselves, and receive them as proof when they further their purpose, and forbid their use only when they seem to prove what they do not want proven. They are not to be blamed for using them, for they could do nothing without them; but after admitting their validity

by using them for their purposes, they have no right to forbid any legitimate use of them.

Availing ourselves of all the means of knowledge within our reach, welcoming all light from all sources, the genesis of all things finite is traced to the infinite. One God created all things. He created all material substances, and made each element to be what it is, and to possess such properties as it does possess. He created the immaterial substances, and gave to all of them the property of energy, and fixed in each such modes of using it as we see manifested. He gave to these doers separate and self-perpetuating existence, and left them, under His direction, to work out His general plans and purposes. Such is the natural, obvious, and spontaneous conception of the origin of things. Any other conception is reached by a strained effort to reach some other, by a distortion or dislocation of facts, by a misuse and misapplication of principles, by suppressing testimony and excluding witnesses, by designedly shutting out the light. "Men love darkness rather than light; because their deeds are evil." The cosmogony of Moses is the cosmogony of rational philosophy. The conception of a passive physical world operated upon by invisible doers, the conception of undistorted human consciousness in all ages, is the most rational conclusion; and science, after all its wanderings, will ultimately return to this first conception of primeval man, but with a clearer conception of immaterial substances which are not gods nor genii.

CHAPTER XVI.

NATURE AND GOD.

Behind our intuitions, behind the doers in nature, outside of all the physical and tangible universe, there is an unmarked and boundless ocean for thought to explore. By some it is called the Unknown, by some the Absolute and Universal Reason, and by some the Infinite God. All landmarks and lines of latitude and longitude there must be projections from consciousness and from the known physical. It is the delight of some persons to explore this trackless ocean of metaphysics, and map it out in its application to the known. Is it an infinite void, or absolute and impersonal reason, or an infinite God? Over these questions the giants delight to grapple. How came a universe to be? Why are things as they are? Why do natural agents do as they do? Why are the necessary modes of the human mind such as they are? Back of all that is they would find reasons for what is, and back of all modes, reasons why they are such modes. Some would even go farther back than this and find some one reason, some one fundamental principle which is the basis of all existence, and which has determined the nature and modes of all that has been and that will ever be. One explorer after another launches his bark upon this ocean, constructs his charts, and brings back to the common world the results of his explorations. But most men start with their predilections and their wishes, which give direction to their research; because of this and because the landmarks are so dim, each differs in some respects from all the

others. The lines projected from the known are so liable to be bent by prejudice and desire, and the lines are so indefinite that comparatively little in this realm is so certain as to force universal acceptance. These explorations are no doubt among the highest and most profound exploits of which the human mind is capable, and the indeterminateness of the results keeps it an ever open ocean in which the intellectual voyagers may hope to make discoveries.

Mine be a less ambitious undertaking, a humbler task. It is very certain that things are as they are, that natural workers do as they do, and that all human minds act after certain and the same general forms of thought. I have not undertaken to find behind these things and modes any reasons why they are so except that their Creator saw fit thus to create them. As I have already said, for the properties of material things, for the modes of the forces, and for the intuitions, or necessary modes of the human mind, I find no reasons but the will and wisdom of God in adapting them to desired ends and contemplated purposes. If I step off from the visible into the invisible, I step not into the unknown, nor into impersonal reason, but into God. I take what I discover as expressions of the divine wisdom and will, and, without trying to prove that there is a God, start with the question, Why does man believe in a God? Whether there is an infallible basis of certitude to be found in the unfathomed depths, or whether men may still find opportunity for doubt, questioning, and demanding proof for every antecedent, we know that most of mankind will ever believe according to the intimations of their own inborn intuitions. Whether such a course is reasonable or not, mankind always have taken, and always will take, their intuitions as basis of belief. We do not propose to go back of them in search for evidence; the willing and obedient are satisfied to begin here.

We have seen that the intuitions of unity and causality conduct us to one infinite cause and Creator. But this is not the conception of God which the mass of mankind have obtained by natural means. Only the very few have, without the aid of revelation, reached the conception of absolute unity in God. The intuition of unity has been, practically in the minds of men, less a means of the discovery of God than a confirmatory testimony of other witnesses. The intuition of causality has led the mass of mankind to a belief in invisible doers. That is the part that this intuition has performed in giving man a knowledge of the invisible God. The intuitions which have given those who have not had the advantages of revelation a belief in the existence of gods, and finally of God, are these; an intuitive religious consciousness consisting of:

(1.) The intuitive disposition to worship. This makes man predisposed and inclined to worship. This as a subjective mode declares the existence of its object. This, first of all, suggests to man the existence of a being to be worshiped. This is the basis of all religion, in the enlightened, as well as the savage.

(2.) Conscience; which in its operations in human nature is a perfect model of a moral government, and declares the existence of an objective moral government, with a moral governor, and man the subject.

(3.) The instinctive disposition to govern and be governed. This is the subjective basis of all government among men. It gives to man an instinctive cognition of the duties and responsibilities of the governmental relation among men; of the rights of duly constituted authority; of the duty of submission and obedience to such authority, of dependence upon the governor; and it originates an expectation of guardianship, guidance and care. This subjective mode suggests an objective providential government in which all men are subjects. The con-

sciousness that we are subjects, and our feeling of dependence declare the existence of one to whom we are subject and upon whom we depend.

(4.) That intuition which has been called marvelousness, the desire for things strange, wonderful, supernatural. This leads religionists of all kinds, in all nations and ages to expect and demand as a part of their religion the mysterious, wonderful, supernatural.

(5.) That intuition which has been denominated spirituality. This enables man to form conceptions of spirit beings, to believe in the existence of such, declares their existence, prepares man to believe in the possible existence of human spirits separate from the body, qualifies him for communication and intercourse with other spirits without the use of physical organs—perhaps to a very limited extent with human spirits, embodied and disembodied—but more especially with the divine Spirit, in conscious influence and presence, by which God is known in the depths of the soul as by conscious touch, really and certainly known in His attributes of love and tenderness and care, and in responsive communication,—as real and certain as the external tangible world; not believed in but known; it makes Him not the unknown, or the inferred, or the deduced, but the known.

The philosopher whose unbelief has shut God out of personal contact with his own nature is poorly prepared to say whether there is a God or not, or to say that He is unknown. "If any man will do His will, he shall know of the doctrine." To the rejector God may be unknown, but to the devout child of faith He is the known, not through logical processes, not through His manifestations in nature, but in the soul's deep communion. "Whom the world cannot receive, because it seeth Him not, neither knoweth Him, but ye know him, for He dwelleth with you, and shall be in you."

Sad that some men with the brightest intellects should turn away from the evidence they have within them, and plunge into the depths of metaphysics or roam the universe, as though God was away off beyond the limits of star-sprinkled space, and return alone, fatherless, homeless, shut up in a cold, void, lightless world, an atom in the jaws of fate, measuring a moment in the eternity of darkness, hoping only to end their solitary existence and cease to be, dead to the infinite Love which invests them with immortal light and life, and who ambient waits for recognition and trust. "That they should seek the Lord, if haply they might *feel* after Him, and find Him; though He is not far from every one of us; for in Him we live, and move, and have our being."

Besides the foregoing there arises in our experience a feeling of helplessness, of conscious inability to know and do the right unaided, and a sense of incompatability between our hopes and our conscious deserts, a consciousness of guilt and hopes of mercy. These feelings, common to the race, prepare man to gladly welcome the announcement made by divine revelation: "God so loved the world that He gave His only begotten Son, that whosoever believeth in Him should not perish, but have everlasting life."

These intuitions together constitute a religious consciousness which relates us to a supreme being, governor, father, judge, and object of worship. Such a subjective consciousness leads man instinctively to believe in the existence of its objective relative, and in his extremity to cry out unto God.

The being thus declared was at first very naturally identified with the invisible doers declared by the intuition of causality to be; and the result was a belief in many gods. A few of the profoundest philosophers, grounding faith upon these intuitions, and following to the ultimate the

intuition of unity, have reached the thought of the one infinite God. These intuitions make a belief in some invisible god, or gods almost a necessity to man, a necessity which nothing but a persistent determination not to admit the testimony of the intuitions can obviate; and then the forced unbelief can only land the soul in an agony of unrest. As a man who professes to disbelieve the intuition of causality will, in all his dealings with nature, act as though he did believe it; so does the professed Atheist in his unpremeditated and instinctive doings in hours of emergency, act as though he did believe in God. Whatever be the declared belief, the lost and trembling soul, when all else fails, instinctively turns away to the Father for rescue.

On the authority of these intuitions alone we may presume upon the existence of God. Then when we find the verified intuitions of unity and causality corroborating these and adding their testimony, we find it to be a fact as well established as almost any scientific generalization. The belief in the existence of dynamic energy in the objective world has not so strong a foundation as the belief in God. The existence of God, then, becomes a fact which casts its light upon the mysteries of creation. We have thus far proceeded in the light of our senses and reason, including absolute truths and necessary processes of mind. These have guided us to God, and thus corroborated those intuitions which immediately declare Him. If we should now, from the standpoint of a divine Creator, re-survey nature, we would have no occasion to alter anything we have said. Indeed, we have all along presumed upon His existence; for from such a presumption it is scarcely possible to separate the willing seekers after truth.

Truth is one and never contradictory. If in examining one department of nature we arrive at one conclusion, and in our survey of another department we reach a different

conclusion, we may be sure that the testimony is not conflicting, but that we have misunderstood the voices, or misinterpreted the language; and it becomes us to retrace our steps, review our observations, and correct our bearings, till the two meet in harmony. The subjective witnesses having declared that there is a God, now to say that we must study nature as though there was no God, to endeavor to explain it all with the supposition that there is no God, to so construe the testimony of nature as to, if possible, exclude God,—this is a forced effort to try to make the witnesses in one department of nature contradict the witnesses in another department. The subjective witnesses declare so positively that there is a God, that none who receive their testimony doubt it. This is the testimony in one department of nature. The question now is, not can the testimony of physical nature be so construed as to contradict this subjective testimony, but does it naturally, and according to its most obvious meaning agree with it?

The subjective witnesses having declared the existence of God, he who will not admit this testimony, but proposes to solve the problem of the universe by objective sense discovery only, intentionally disables and mains himself—for what purpose? After having been taught by our intuitions and our reason that there is a God, if we go into the objective world, and by shutting our eyes to some facts, distorting others, and bringing still others into unnatural classifications, by refusing to look beyond appearances for substance and cause, by forbidding the use of subjective principles, and yet surreptitiously using such as will further our purpose, by suppressing testimony and excluding witnesses,—if by such means we can force ourselves into a certain state of opinion, what have we gained? and what motive can prompt such a course but a desire to get rid of the belief in God? Let not him who thus forces

his own unbelief say that man is not responsible for his beliefs.

But such an effort to prove that there is no God disqualifies men for any correct understanding of nature, and renders unnatural and false any system of science they may construct. If there is a God who created and who governs the universe, any system of nature which ignores this fact, which explains and adjusts and relates things so as to exclude all intimations of Him, must be erroneous and false science. If He created, any theory which excludes His agency in creation, must be false. If He adjusted things, any theory which supposes self-adjustment, must be false. If He created things as distinct substances and distinct beings, any theory which supposes a transformation of one thing into another, must be false. Thus it matters not what phenomena of nature we undertake to explain, if there is a God, they must be explained one way; if there is no God they must be explained another way. If there is a God, then there can be no true science on the supposition that there is no God, or while excluding Him, or while leaving Him out of our explanations. If there is a God, if He is the most important of all the agencies in creation, if you believe and know that He is and does, you may know beforehand that any system of the universe which purposely excludes Him, which gives Him no place in the universe, which purposely adjusts every part of the system so as to allow Him no place, must be false and valueless as a system and as science.

The systems of dynamism and atomism, so characteristic of the philosophy of modern science, are maintained with the avowed and advocated policy of admitting into the calculation nothing but matter, motion and energy, and the exclusion of all subjective and metaphysical witnesses. But for this suppression and exclusion many of the the-

ories peculiar to modern science could not have attained the place they now occupy in the public mind; the verdict in their favor has been obtained by the suppression of the most important testimony and by presumptions in conflict with all our highest intuitions and universal reason. Let all the witnesses come upon the stand, let reason's voice be heard, let human nature in all its entirety speak, and they have no chance for life and being.

There can be no true philosophy of science while men build upon false views of the causal relation, nor as long as men refuse to look beyond phenomena for causes, nor as long as men deem it not essential that phenomena have energizing causes. It is time that science be rescued from this phenomenalistic policy. It is time that the public know what a thing it is which is called modern science. It is time that this everlasting doing without any doer be expunged from the speculations of sensible men.

I would not under value the facts discovered by this sharply looking age; for these we give scientists all due credit. Still greater have been the achievements of this age in the application of discovered facts to the utilities of life. But it is not for these that scientists glory most, but for their generalizations, their theories, and their speculative systems. In reference to these modern science is not a marked success.

Scientists scorn metaphysics, and yet hold most tenaciously to the law of continuity, applying it to motion, energy, force, matter, life, mind, political economy, social science, philosophy, and religion, explaining all as an endless stream of existence, unchangeable in quantity but evolving itself into endless new and varied forms. We have found that this law, as far as it asserts transmutation has no application to substance, and as far as it asserts continuity has no application to anything else.

This law has been identified with the law of cause and

effect, and thus for it is claimed all the authority possessed by that. In the everchanging form of existence, that which precedes is the cause, and that which succeeds is the effect. All the different forms of matter are one and transmutable, and the days of alchemy are back upon us. The trouble with all this is that no such transformations ever do occur. Oxygen never consents to become hydrogen; nor carbon, nitrogen; nor iron, gold. Gravity obstinately refuses to become heat, and every other force to become any other. The process of causation is continually going on before us; yet no man has ever seen one case where the cause passes over into and becomes the effect. This is a case where we can appeal to facts and experiments, and have a demonstrative answer to our inquiry, and facts demonstrate that such a doctrine or process of causation has no place among natural phenomena.

This supposed law of continuity has been used in explanation of the genesis of things, without a creator; and in solving the question of the how of creation, admitting a creator. Starting with the one sole substance of Spinoza, unchangeable in quantity, the process of creation was a self-evolution of this one substance into multiplied substances, till the present universe of complicated varieties of being and life appeared; the product of a self-evolving, unintelligent, unconscious substance. This is pantheism. Facts declare that no such transformations now occur, and lead us to believe that none ever did thus occur.

Others, admitting that creation began with a self-existent, intelligent Creator, assert that creation was a conversion of portions of His own substance into finite substances; and, as the quantity is unchangeable, all that has gone out of God must be included in Him to preserve His infinity, and we and matter are parts of God—how far is this removed from pantheism?

I do not suppose that it is possible for us to understand the how of creation; but I deny that this supposed law of continuity imposes any restrictions upon divine power. A generalization based upon finite powers is limited to the finite, and can declare nothing in reference to the infinite, —the generalization is as finite as the facts from which it is deduced. God cannot act a contradiction without destroying His own unity. But not being at one time, and being at another time are no contradiction. There is nothing in the nature of things or in any absolute truth which forbids the supposition that God created matter without using any previously existing substance to make it of. The intuition of causality requires us to posit something before every thing finite that is; but all that it requires when anything begins to be, is that some agent with adequate powers energized to produce it. Our intuitions do not inquire whether it was made out of previously existing substance or not. I see no reason to doubt the power of the infinite God to create new substance where nothing before was. I think that those Theists who thus limit the power of God at the behest of a misapplied finite generalization, concede quite too much to unbelief.

CONCEPTS OF GOD.

In view of our doctrine that immaterial substance is extended, and in view of our definition of substance—space-filling existence—the reader has perhaps wondered what I would say of God as immaterial substance. One of the insolvable problems of philosophy has ever been, How can a substance which has no space relations operate upon a substance which has space relations? how can a thing which is not extended operate upon a thing which is extended? I will not try to solve this problem, for to me it contains a contradiction. I simply say that an unex-

tended thing cannot at the same time operate over an extended surface. Place one measuring rule upon another, both of the same length, can we say that one is extended, and the other is not? I can see no alternative of opinion here. To become related to a thing which has space relations, is itself a space relation. To declare that God has no space relations, is to shut Him off from all relations to finite beings.

Under the doctrine that immaterial substance has no extension, I can see only two possible conceptions of God: either He is a collection of attributes, or else He is the unknownable. What is God? He is omnipotence, omniscience, ubiquity, infinity, and eternity. Or we may express Him in more personal attributes and say, He is holiness, truth, love, justice, and mercy. Then we commit the absurdity of supposing that attributes may exist and act apart from substances. This view bore its fruit in the mythology of Greece, in the personification and worship of attributes as so many distinct Gods.

Or, secondly, we must look upon Him as the solitary infinite One, dwelling disconnected and remote from every thing else in the universe, having nothing to do with matter or men. This ultimate the penetrating mind of the Hindoo long ago reached in the person of Brahm. Modern philosophers have reached about the same conception in the "unconditioned," the "absolute," and the "unknown." It matters not what path of speculation we pursue, if we start with the assumption that immaterial substance is unextended, has no space relations, we can reach no ultimate but Brahm or the Unknown. The wonder is that men should travel so long a circuit to reach it. It is because the conception is so at war with all the intuitions of human nature that it is long before men can bring themselves to accept the legitimate end of their own philosophy. The ultimate appears to me to be plainly contained in the

first proposition. If God has no relations to space, He has no relations to anything which has relations to space. I know that many assert the first proposition, and yet, overwhelmed with the evidence of God's relations to earth and man, reject the ultimate conclusion; but this they do, as it appears to me, at the expense of their consistency, and embrace a contradiction.

I do not presume to try to solve the mystery, of the infinite. But this we know that an attribute cannot exist without substance, and that we have no special interest in the existence of an abstract, unrelated infinite. If God is substance, and if He operates simultaneously over an extended surface, He is as extended as that surface. If He is here, he has a space relation. Here, there, everywhere are meaningless terms to apply to Him, if He has no space relations. Presence is a space relation. Omnipresence is an infinite space relation. If God does He is where He does; then He is in a certain place in space. Doing without being where the doing is, is a contradiction. If He does over an extended surface, He is as extended as that surface. If He does in two places remote from each other, he is in both places—He is where He does—then His substance extends through the distance which separates those places. Extension is distance in space occupied by substance. Is He in all parts of a measured distance in space, extending through that distance, and yet not extended?

How can he who thinks that God is the only doer in nature assert that He is not extended. Gravity and all the other forces are in every atom of a body of matter. Are these forces God, in every atom of that body, as broad and deep and long as that body, and yet has He no extension? That which is in different portions of space at the same time, has extension. Because a material body is in different parts of space at the same time, shall we

say it has extension and then when an immaterial substance is in the same different parts of space, shall we say it has no extension? Every substance which is in different parts of space at the same time is extended.

Nor can it be said that by giving God extension we make Him divisible into parts, and thus destroy His unity and infinity. We talk about parts of space, and in our thoughts there are parts of space, but space is indivisible, and infinite. There are different portions of space, but no divisible parts. No more do we make God divisible into parts by conceiving different extended portions. The unity of time, space and God is not destroyed by any proper use of the word parts in reference to them. "All of God is everywhere," it has been said. Yes; all His attributes, not all His substance. All the properties of a material substance are in every atom of it. All the attributes and powers of God are in every point of space. The conception of God which was born in the darknes of pagan philosophy is still retained by Christian Theists when they approach the subject from the standpoint of philosophy; but when they speak of God according to the conception derived fcom the Word of God, they scarcely use a sentence that does not give Him space relations.

If the writers of the Scriptures had written for the express purpose of imparting a conception of the infinite, eternal and almighty One, revealing Himself in all the detailed relations of time and space, localized here and there, they could scarcely have done more than they have in this direction. From the beginning to the end, the Bible assigns space relations to God; and yet must men continue to echo the pagan postulate which conducts us only to Brahm or the unknown?

In reference to God's present relation to the universe there are a variety of opinions. Some think that He has no agency in natural phenomena, and some that He is the

only agent in nature. Let us see how nature is explained by those who think His agency not necessary. Men have been studying natural phenomena in all ages. At first they projected from themselves an explanation, and concluded that all moving things were moved by spirits in them, or by the gods. In course of time they noticed that the same motions uniformly occur in the presence of the same physical conditions, and they began to attribute the motions to the physical conditions. This practice continued and extended more and more as science advanced, until at last men came to conclude that all motions in nature could be attributed to physical conditions as causes. It is the boast of science that it has crowded the supernatural back, back, back, step by step, until some have thought it possible to crowd it entirely out of the universe, and that all natural phenomena could be explained by supposing only natural causes.

The uniform mode of motion discovered in the presence of certain physical conditions began in course of time to be called a law of nature. When a man has discovered the particular mode of doing which uniformly appears in the presence of certain physical circumstances he has discovered what is called a law of nature. Many such discoveries were made, so that in time there came to be very many laws of nature known to science. Then these modes of doing, or laws, began to be called causes, and were spoken of and treated voluminously as agents or doers, and vast fields of phenomena were explained by them as natural cause, doers. I need not labor to show to intelligent readers the folly of treating modes of motion, modes of doing, as doers. But I will take a single example as an illustration of the process of explaining natural phenomena by natural causes.

Water rises from the surface of the ocean in the form of vapor, forms a cloud, is carried by wind over the land,

and falls as rain upon the earth. Now for the explanation. It is the nature of water at certain temperatures, and in a less degree at the lowest temperature, to rise in the form of vapor. This is attributed to the nature of the water. Some other substances become vapor much more readily and rapidly than water, while some other substances must be raised to a very high temperature before they become vapor. These differences are attributed to differences in the properties of the substances. This vapor, being no heavier than the atmosphere, rises and diffuses itself freely among the molecules of the air. A current of wind passing by carries this vapor over the land. The wind has a natural explanation. When the atmosphere in one locality becomes, from any cause, more rare than the common standard, it rises, and the heavier air around rushes in to fill the partial vacuum thus produced. This rushing air we call wind. The motion of the wind drives the molecules of the water vapor together, they cohere and form fine drops. They then become visible, and we say a cloud is formed. Or a portion of this vapor enters the ascending current of air and is carried into the cold upper regions, and, deprived of its heat, the molecules fall together in fine drops, and a cloud is formed. This process of striking or falling together continues, the drops become larger, and fall to the earth in the form of rain. Then we can see natural reasons why this water vapor is carried over some countries and not over others—the prevailing direction of the wind, intervening mountains whose chilly tops catch and retain the water vapor, etc.

Now, have we not given a natural explanation of the phenomena of rain? We have not had to introduce the supernatural, nor mention any natural doers, except physical circumstances. We have given such an explanation as the scientists of which we are now speaking give of natural phenomena, such as seem to satisfy them, and such

as a great many people appear to think are complete explanations. But what have we done? We have, according to the fashion of phenomenalists, described the passing panorama of successive phenomena; but we have not gone down once into the strata of causes or doers which underlies all this. What held the molecules of water together in the first place, more strongly in water than in some other substances, and less strongly than in others? What separated the molecules of water and pushed them off in the form of vapor? What lifted the water vapor up from the earth against the force of gravity? What holds the molecules of air apart in the form of a gas? What presses the molecules of air together and on to the surface of the earth? In other words, what moves the air in the form of wind? What pushes the molecules of air apart in the rarer more than in the denser portions? When the molecules of water were driven together, what joined and held them together? When the drops had become larger, what drew them to the earth?

All these questions demand doers, none of which were alluded to in our explanation of the phenomena. In each of these cases there is doing, and there must be a doer or doers. We see from this how far short all these panoramic explanations of natural phenomena come of being real and complete explanations, and that they are really only deceptive illusions.

In all these cases there are doings; are they the work of natural doers? Suppose we conclude that they are, then these doers require an explanation, and we ask, why do they do as they do in these cases? Before this question we and all men stand stark and silent. In all the history of philosophy there has never been a single reason given or proposed why these natural doers do as they do. Why does gravity draw matter together? A perpetual scientific blank. Here, then, we ar at the end of natural explana-

tion. It may be said that they do as they do because it is their nature to do so. Then we ask, whence came their nature? from whence did they derive their specific modes of action? To this no man can give any answer but, "In the beginning God created the heavens and the earth," and gave to each of these doers its specific modes of action.

But are we sure that these doings are the work of natural doers? Possibly we have gone a step too far, and called them doers when they are only modes of the divine doing. As I look out of my window I see a beautiful white cloud floating by, and I say, the wind carries that cloud, in the same sense that the car carries a man; but the car does not carry the man, the car is not the mover that moves the train. Nor can I think that God is now moving that cloud along. I have a very satisfactory consciousness of the divine presence; He is all about me and in me. He knows all my thoughts, and I believe that He sometimes directs my thoughts, but it does not seem to me that He is now energizing to move that cloud through the air. The physical circumstances which we find to uniformly attend this phenomenon, and the natural doers which we may suppose in this case appear to me to be the preferable explanation. If God does all these things directly, it seems to me that the storms would not always come just as and where they do, and that the rain would not always fall just where it does and where it does not. If He distributes the rain directly, we can see no reason why He should not send some over Egypt and the Sahara desert. But we can see physical conditions which have some relation to these phenomena and seem to be at least necessary conditions of their occurrence as they do occur. If He does all these things directly He has certainly made Himself very dependent upon physical circumstances; He acts a certain way only in the presence of certain physical conditions, and in the absence of those conditions He does

not act at all. It appears to me that those who say that God has no agency in nature, and those who say He is the only agent in nature, occupy the two extremes between which the real truth lies. But we will have to consider this question a little more in detail.

Some who believe that matter is eternal, and some who believe that God created new substance out of which to form a universe, think that He is the immediate and only doer in nature. This has been the opinion of some religionists perhaps in all ages. Descartes gave currency and authority to it in modern philosophy. When it was thought that the unity and transmutability of the inorganic forces were proven, many theologians said, "Yes; and that one is God." Those who thought that by proving the self-active power of the natural forces and their unity they had rendered the supposition of a God unnecessary were thus met: "You have shown that force is self-active, and that really there is only one force operating in nature; that is what we have always said. God is the only moving power in nature. Your philosophy confirms our doctrine."

But the transmutability and unity of the forces have turned out to be fictions. Now these cannot be used to turn God out, nor to show His immanence; and His relations to nature remain unaffected by these doctrines. And now, are all the doings in nature the doings of God? Are the forces separate and independent agents? or are they the energizings of God? Are there any self-active agents on earth? If there are, which and what are they?

Our consciousness of separateness, and independence, and freedom, and accountability, is proof to us that the energy active in our minds and bodies is not the immediate energizing of God, and that we are self-active agents. Each man knows for himself that he, and not God, is the doer in all his conscious and voluntary activities. We have, then, in conscious human beings examples of agents which

are capable of separate and independent action. We thus know that there are agents on earth which do control and direct their own energy, and, within certain limits, determine when and how they shall act. They have their inherent fixed modes of action, which limit their activities to certain channels. Within those limits we can act or not act, and perform one or another kind of acts, as we please.

We have, then, the existence of self-active agents as a fact in nature. Here is a class of agents which we know to exist in nature. How extensive is this class? What things are included in this class? The close resemblance between the forces active in the animal body and those in man, in the absence of any proof to the contrary, places them in this class.

There are many objections to the supposition that even the inorganic forces are the immediate energizing of God. The uniformity in their modes of action indicates that each is an entity with a nature, modes, and powers of its own. As properties indicate a substance, and a particular set of properties indicates a particular substance, and the same set of properties always the same substance; so the uniform modes of the forces identify each as always the same substance. It is true, God could limit Himself to certain modes in certain circumstances. He might say to Himself, I will in certain circumstances always act in certain ways; on the occurrence of certain conditions, I will always perform certain acts. I will always draw separate bodies together with a degree of energy just proportioned to the quantity of matter; and I will proportion my drawing inversely to the square of the distance between them. He might say and do thus; but it seems far more probable that He has created a separate agent to do this work, as He has done in the creation of man, and fixed in its nature such modes of doing that it will always act according to this manner. Then the fact that we can see

that a radiating force—a substance located in a body, and radiating from it in all directions—would decrease in quantity in any given space as the square of the distance increases, seems to render it very probable that the force is there located, and thus radiates. But if God, who is equally and everywhere present, thus does, we can see no reason why the power varies as the square of the distance, except that it be His will thus to act.

The dependence of the doers in nature upon conditions for their powers to act, seems inconsistent with the character of the infinite God. Some of the forces cannot act in the absence of certain conditions. Is this true of God in reference to physical things? It is true, He might say, in the presence of certain physical conditions, I will energize to unite substances chemically; in the absence of those conditions, I will not energize to unite them: if they are dissolved in water, I will energize to unite them; if they are not dissolved in water, I will not energize to unite them. He might say, in the presence of conditions supplied by man, I will energize to carry a bullet through a man's head; and then on that condition, I will immediately commence the work of decomposition and decay in that man's body. He might say and do all this, but it does not seem to me at all probable that He does.

By such a plan of management He would place Himself under bonds of necessity to always act according to certain modes on the occurrence of certain physical conditions. He cannot act otherwise than according to those modes. He must always act as gravity acts, as the chemical force acts, as the crystallizing force acts, as cohesion acts, as electricity and magnetism and heat and light act. In the circumstances in which they act, He must act according to their modes, and He can act no other way. On the occurrence of the conditions, He must act, He has no power not to act. The conditions having

been supplied by some finite agent, He has no option, He must act, right or wrong, or whether the results are good or bad. He must do, and he must do according to those pre-determined modes, whatever the results may be. We would think it wrong to bind ourselves under bond which compelled us to do, right or wrong, and to do after certain fixed modes, even when the results of so doing would be evil and crime. If the inorganic forces are God's immediate doing, He has thus placed Himself under the absolute necessity of obedience, to act according to the dictation of the most degraded and corrupt human beings; He has made Himself their agent, their slave, to do their bidding, and thus He becomes a participant in all the crimes committed by man. The incendiary by supplying the conditions, compels God to consume a house or a city. The murderer, by supplying the conditions, compels God to carry a bullet through the heart of a man. God is the executive agent in the carnage of war, and the power employed in all the crimes committed by man. All this He does at the behest of humam passion, and in helpless obedience to all that is most depraved in man. If it be said that God controls and determines the conditions also, and thus acts only when and as He wishes to act, then we land in absolute, irresponsible fatalism.

It is objected to this by some, that making God the creator of separate and self-active agents only removes the responsibility one step farther back, and he is still responsible for all they do. Then is God responsible for all the deeds of man? Is there no responsibility outside of the Creator? Is God, and He only, responsible for all the wrongs, and sins, and crimes of man? Is he to be blamed for all His created self-acting agents do? He has endowed the inorganic forces with modes which are necessary for such a universe of related things as now exists. Without

these forces and without their present modes of action no such universe could be. The acts which they perform when left to themselves are generally such as God approves, and such as He designed. They of themselves commit no crimes. If man supplies the conditions of their doing wrong, not they, nor the God that made them, is blamable for the wrong. He made them, endowed them with their modes, willed the good, created them so that they would of themselves work out the good; but man comes in and supplies the conditions of their doing evil. If it was God, an intelligent, knowing being, that was there doing, knowingly doing the wrong, yet bound by his own self-imposed law so that He must do it at the command of criminal man, He would share the responsibility. But when unconscious and unknowing agents are sent forth to work, with modes which of themselves accomplish only good, if man turns them to evil, upon him only rests the responsibility.

God created the forces, and gave them their modes. He also created material substances, and gave them their properties. The properties of the material substances are employed in the commission of crime, as well as the modes of the forces. The properties of arsenic are such that if it is administered to a man, he dies. Because of these properties in arsenic, has any one ever attempted to make God to share in the responsibility for a murder committed by administering arsenic? No one thinks of attaching blame to the Creator when man takes advantage of the properties of matter to do evil. When man takes advantgae of the modes of the forces to do evil, the case is precisely the same. But if God was Himself the doer, and voluntarily, or from self-imposed necessity, exerted His energy to do the deed of wrong, and without His energizing the deed could not be performed, He would be responsible for the wrong.

But there may be cases where the forces effect what appear to us to be disasters in which man has no part. The ravenous instincts of beasts of prey are the direct creation of God. Yes, and if the objects of prey do not die by some other animal, they will soon die of old age, the direct work of the forces in their own bodies as God made them. He designed that they should die. If animals ate only vegetable food, far less animal life could be than under the present order of things. By endowing much of the food of animals with animal life, the sum of animal life on earth is greatly augmented. If animal life is a higher and more desirable state of being than vegetable life, if sensibility is a blessing, an enjoyment, the sum of enjoyment on earth is far greater than it could be if animals ate only vegetable foods. For a part of the food of animals to be endowed with life and enjoyment for a time, and then die, is better than to have it all insensate, and incapable of any enjoyment. The present arrangement secures the greatest total sum of enjoyment. If it is wrong for a wolf to kill a sheep for food, it is wrong for man to do so. More large animals are killed for food by man than by all the beasts of prey on earth. But animals, having the instinct of prey, may be by it prompted to destroy a child or a man, and we call it a calamity. God may or may not have designed that particular event. Without this arrangement the sum of enjoyment would be much less; with it a calamity is possible.

A storm may bury a fleet; an avalanche a hamlet; an earthquake a city. Without gravity no system of worlds, or even individual worlds, could be. Without molecular repulsion, heat, gravity, the chemical force, and so forth, no system of nature, no life could be; with them storms, avalanches, and earthquakes are possible. The properties of matter are involved in these catastrophies, as much as

the modes of the forces. No one thinks of blaming God for these catastrophies through the properties of matter; no more is He to be blamed for them through the modes of the forces. But if He is the immediate and constant doer, voluntarily, or under self-imposed necessity, energizing to effect them, He is responsible for them. They occur under the operation of means and agents with properties and modes without which the good could not be. The finite is imperfect; and the question is, shall the finite and imperfect be? or shall only the infinite and perfect be, sole dweller in the abode of eternity? But some of these catastrophies God may have designed, designed for the accomplishment of greater ultimate good. They utter His awful voice, and manifest His dread power, and prostrate man in awe before Him.

Some have designated the universal force operating in nature by the word will. I do not suppose that they mean an impersonal will, an attribute merely, without any persons of whom it is an attribute. This is only another way of stating the doctrine that God is the immediate and constant doer in nature. There is a manifestation of will in the creation of matter and forces, and endowing them with properties and modes, relating them to each other in a system, and so arranging them that they will work out certain contemplated ends. All this shows that there was in creation an exercise of will, directed by intelligence to the attainment of certain desired and designed ends. But there is no manifestation of will in the operation of the forces in nature. The modes of the forces are fixed, and not optional. They must act according to their modes; there is no alternative power; they must act, and act according to their modes. The forces are separate and independent agents, acting under an absolute necessity to do, and to do according to certain fixed modes. Will appears only in their creation.

Here another question arises in reference to God's present relations to nature. Has He created material substances as means, and immaterial substances as doers, and left the doers to work upon the means, and run the universe alone? No view we can take of God, whether we consider Him as creator, proprietor, or intelligent ruler, can lead us to so suppose. If He created, he had some purposes in creation. If he is proprietor, He has some interest in and care over His patrimony. If He has blind, insensate, unintelligent agents at work, no man would leave them without superintendence. Those who deny God's supervision over His subordinate agents, do not leave men working under them without looking after them, and directing them when they deem it necessary or best. The course they adopt in reference to subordinates in their employ, is the course they would adopt if they were in God's place, and that is the only rational supposition in reference to Him.

But how can God direct the operations of His agents for the accomplishment of special purposes, without violating the "laws of nature?" How does man do it? He sees a stream of water flowing down to a lower level. He supplies the conditions in which the water in falling may be used for running machinery. He learns that heat will change water into steam, and that during its expansion a great amount of energy is exerted. He places around it such conditions that that push may be used for the accomplishment of many purposes. He learns that in certain circumstances combined electricity is decomposed, and that then it will attract its opposite kind, and, if not obstructed. go any distance to join it. He supplies those circumstances, and the force executes his will. In all these cases the man has not violated the laws of nature. He has only supplied the conditions upon which the action of the forces would accomplish certain desired results. Man can, by removing the conditions of the action of a force, prevent

its action, and prevent the results which would follow its action. He can, by supplying the conditions of its action, bring to pass the results which naturally follow its action. He can turn the direction of its energy, and apply it to this, or that. He may supply conditions in the presence of which its energizing will accomplish certain results; or he may supply other conditions, and other results will follow. Cannot He who created these agents do as much with them? This is all that is necessary that He may exercise a special providence over His creatures, and answer the prayers of His trusting children.

The results of the action of the forces in nature are contingent upon conditions supplied sometimes by other inorganic forces, sometimes by vegetable forces, sometimes by brute beings, sometimes by human beings, and sometimes by God himself. This contingency in the results of the energizing of the forces, when they come into relations with conscience and intelligence and free will in man, supplies the objective conditions of moral accountability, and renders man in his state and relations on earth a fit subject of moral government. Thus we have the grounds of a rational theodicy, and the establishment of human responsibility.

The views of nature which we have been endeavoring to expound, are the views which spontaneously arise in the minds of men from observation and experience. We have thus only been putting on paper the common consciousness of mankind, and showing its consistent accordance with true scientific and philosophical principles. The language of common life and common literature accords perfectly with the exposition of nature here given. When men undertake to correct this common consciousness, and substitute in its place some other, they cannot expound nature, nor describe its process, without using language which implies much that has been here written. We are

constantly in intercourse with nature, daily, hourly, dealing with it, conforming to and using its modes or laws, and witnessing its doings. Its obvious processes and modes are plainly discovered by every one. Its occult doers and doings are beyond the reach of direct observation. But the conception which spontaneously arises in the human mind in studying nature, in the minds of every generation, is passive matter and invisible doers. This conception we have found to be rational, and consistent with absolute truths, with facts and with our intuitions. In this age the endeavor is made to substitute in place of this conception self-existent motion in matter. This philosophy could make no headway till it invalidated all the final tests of truth,—it must first convince mankind that it is impossible to know anything, then this might have as much claim upon credence as any conception. A philosophy so contrary to the common consciousness of mankind, and to all the basal principles of truth, so at war with human intuitions, and so destructive of all that men cherish as most valuable, is destined to an ephemeral existence, and will soon take its place among the debris of exploded vagaries. If men could succeed in convincing the world that matter and motion comprise the whole of existence, what have they gained. They have blotted out the highest hopes of man. They have destroyed his belief in the existence and providence of God, or crowded God back into the unknown and voiceless æons of past eternity, away from all relations to living mortals, beyond the reach of prayer and trust, covered the race with blasting, enveloped the world in night, and buried the prospects of the race, both on earth and in the hereafter, in the grave of endless loss. Rather let me cast some rays amid the darkness, pour some disinfectant among the plagues of earth, throw around human destiny here and hereafter the halo of hope, and lead man to find his ultimate rest in the bosom of our Father.

INDEX.

ERRATA.

Page 55, 15th line from bottom, for "all molecules," read the molecules.

Page 72, 2d line of 2d paragraph, instead of one "subject," read one substance.

Page 85, 3rd line from top, strike out "while he."

Page 228, 4th line from top, for "generic disease," read generic desire.

Page 260, 12th line from top, instead of "unperfectly" read imperfectly.